

EASTERN - WESTERN
ARCTIC SEA ICE ANALYSIS
1993

PREPARED BY
NAVAL ICE CENTER
SUITLAND, MD

PREPARED UNDER AUTHORITY OF
COMMANDER, NAVAL METEOROLOGY AND
OCEANOGRAPHY COMMAND
STENNIS SPACE CENTER, MS 39529-5000

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FOREWORD

The U.S. Navy has a long and eventful history of polar exploration, including the exploits of Robert E. Peary in the Arctic to Richard E. Byrd in the Antarctic. Recently, the strategic importance and expanded polar research produced greater national and international requirements for environmental information. Since 1976, the National Oceanic and Atmospheric Administration (NOAA) and the Navy (Naval Ice Center) have worked together at the Joint Ice Center (JIC) in Suitland, Maryland; the combination of their resources and efforts continues to satisfy the demand for environmental information in both polar regions.

This publication is the 20th edition of the annual Arctic sea-ice atlases prepared by the JIC. The atlas contains weekly charts depicting Northern Hemisphere ice conditions and extent. The significant use of high resolution satellite imagery, combined with valuable ice reconnaissance data from various sources, has greatly improved the accuracy of these analyses.

The purpose of this atlas is to provide the user with reliable weekly hemispheric ice analyses. These charts are prepared by experienced Navy and NOAA ice analysts, who plot and evaluate numerous data sources:

- a. Conventional shore station, ship, and aerial reconnaissance observations;
- b. Satellite data from various sensors. Table 1, located on the inside back cover, lists these sensors and their availability;

A final product is synthesized from the inputs described above. When insufficient data is available, estimated boundaries are plotted, using meteorological data and computer generated ice drift vectors to determine estimated ice position.

Joint Ice Center
Naval Ice Center
4251 Suitland Rd, FB#4
Washington, D.C. 20395

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
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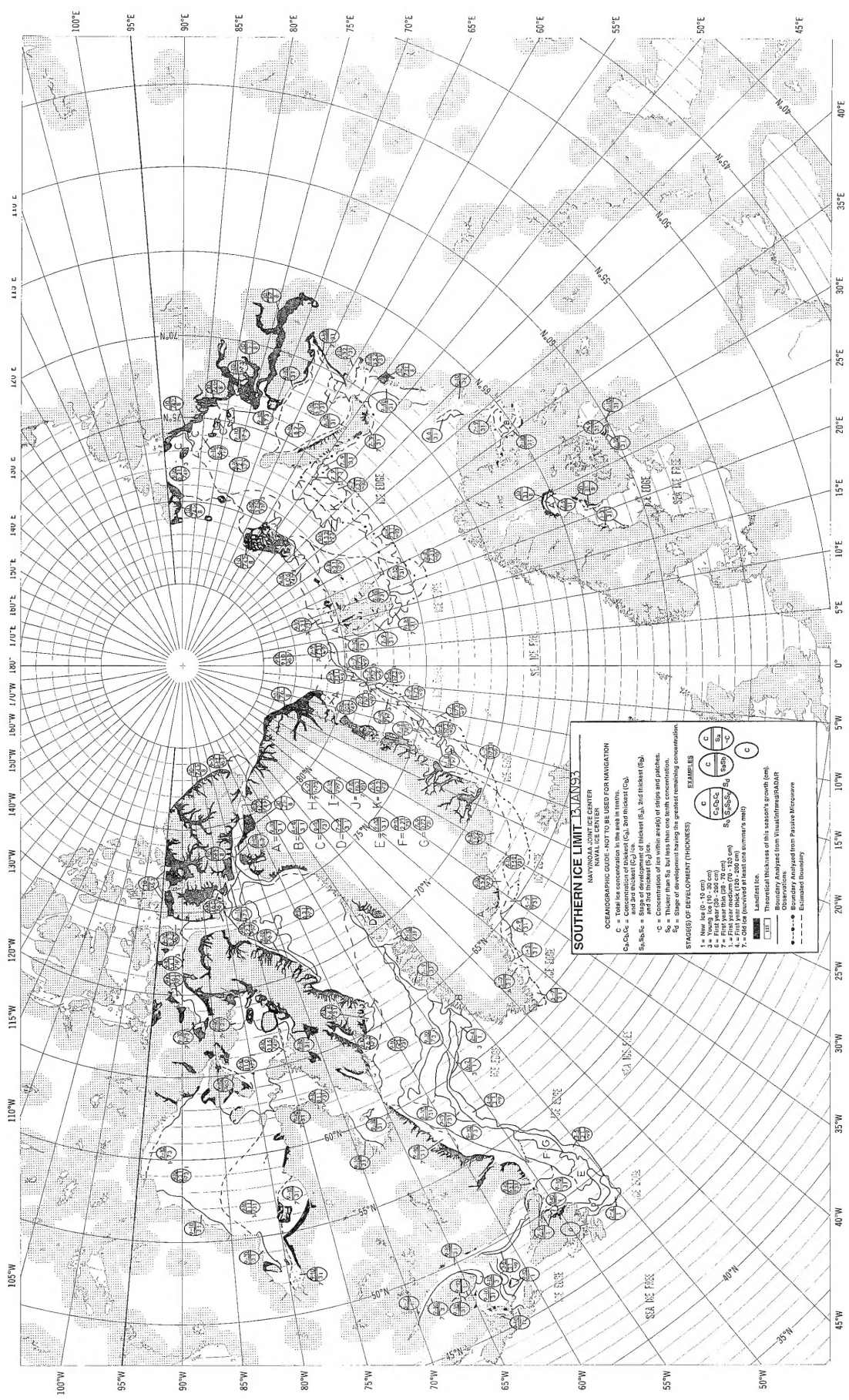
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SOUTHERN ICE LIMIT 13 JAN 53

NATYNAAA JONGE ICE CENTER

OCEANOGRAPHIC GUIDE - NOT TO BE USED FOR NAVIGATION

C = Total ice concentration in the area in tenths.

S₁S₂S₃ = Concentration of thickest (S₁), 2nd thickest (S₂), and 3rd thickest (S₃) ice in area (in tenths) of slope and patches.

S₄ = Thicker than S₃, but less than one tenth concentration.

S₅ = Stage of development having the greatest remaining concentration.

STAGES OF DEVELOPMENT (THICKNESS)

1 = New ice (< 15 cm)

2 = First year ice (15 - 200 cm)

3 = First year ice (200 - 250 cm)

4 = First year ice (250 - 300 cm)

5 = First year ice (300 - 350 cm)

6 = First year ice (350 - 400 cm)

7 = First year ice (400 - 450 cm)

8 = First year ice (450 - 500 cm)

9 = First year ice (500 - 550 cm)

10 = First year ice (550 - 600 cm)

11 = First year ice (600 - 650 cm)

12 = First year ice (650 - 700 cm)

13 = First year ice (700 - 750 cm)

14 = First year ice (750 - 800 cm)

15 = First year ice (800 - 850 cm)

16 = First year ice (850 - 900 cm)

17 = First year ice (900 - 950 cm)

18 = First year ice (950 - 1000 cm)

19 = First year ice (1000 - 1050 cm)

20 = First year ice (1050 - 1100 cm)

21 = First year ice (1100 - 1150 cm)

22 = First year ice (1150 - 1200 cm)

23 = First year ice (1200 - 1250 cm)

24 = First year ice (1250 - 1300 cm)

25 = First year ice (1300 - 1350 cm)

26 = First year ice (1350 - 1400 cm)

27 = First year ice (1400 - 1450 cm)

28 = First year ice (1450 - 1500 cm)

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35 = First year ice (1800 - 1850 cm)

36 = First year ice (1850 - 1900 cm)

37 = First year ice (1900 - 1950 cm)

38 = First year ice (1950 - 2000 cm)

39 = First year ice (2000 - 2050 cm)

40 = First year ice (2050 - 2100 cm)

41 = First year ice (2100 - 2150 cm)

42 = First year ice (2150 - 2200 cm)

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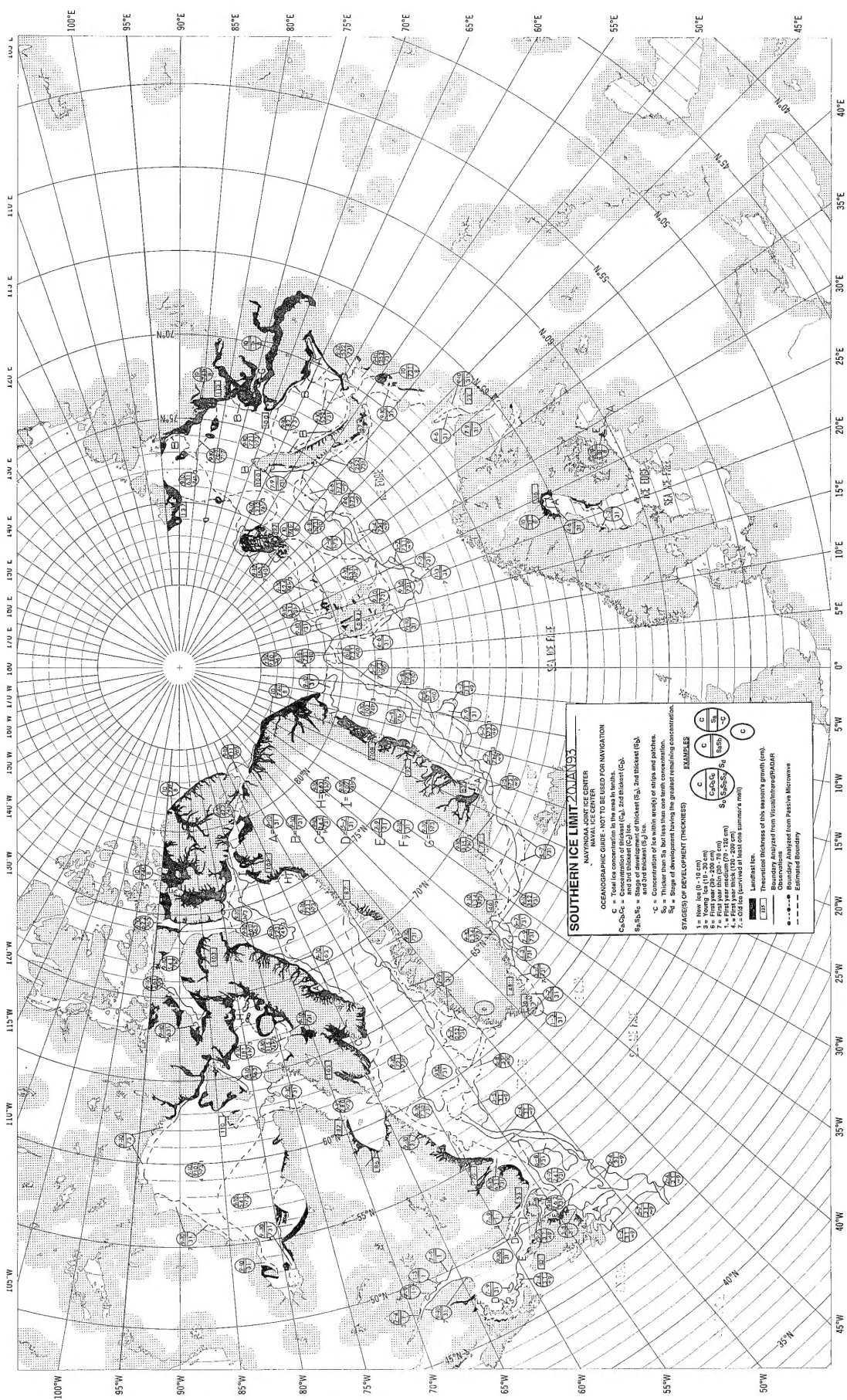
98 = First year ice (4950 - 5000 cm)

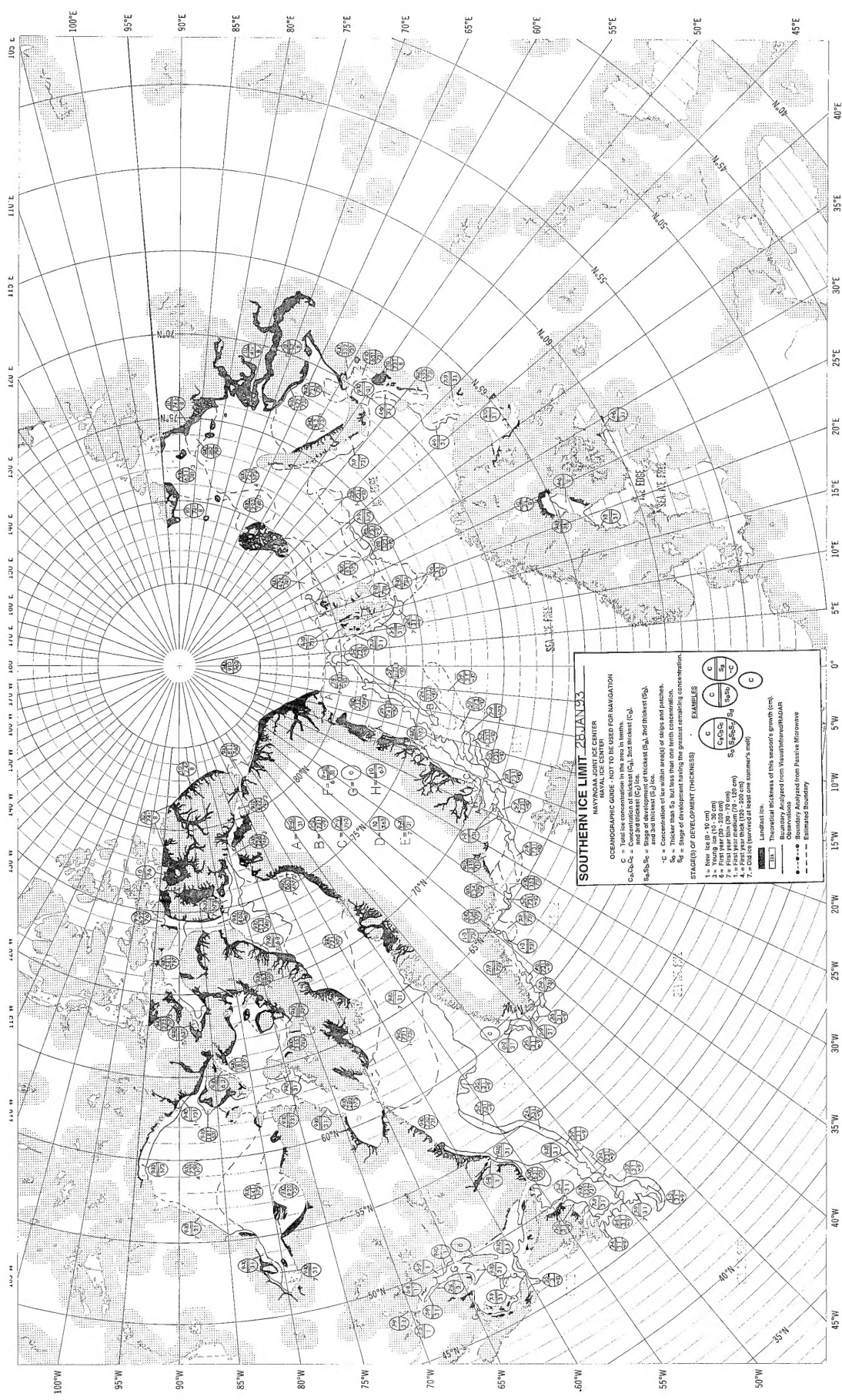
99 = First year ice (5000 - 5050 cm)

100 = First year ice (5050 - 5100 cm)

Legend:

- Landmass
- Theoretical thickness of this season's growth (cm)
- Boundary Analyzed from Visual/Infra-Red/Radar
- Observations
- Estimated Boundary





SOUTHERN ICE LIMIT - 25 JAN 1953

NATYNOVA JOINT ICE CENTER
OCEANOGRAPHIC GUIDE - NOT TO BE USED FOR NAVIGATION

C = Total ice concentration in the area in tenths.
C₁C₂C₃ = Concentration of ice in tenths (C₁ is top, C₂ is middle, C₃ is bottom).
S₁S₂S₃ = Stage of development of thickness (S₁ is top, S₂ is middle, S₃ is bottom).
-10 = Concentration of ice within width of ships and pictures.
S₀ = Thicker than S₁, but less than one term concentration.
S₄ = Stage of development having the greatest sampling concentration.

STAGES OF DEVELOPMENT (THICKNESS)

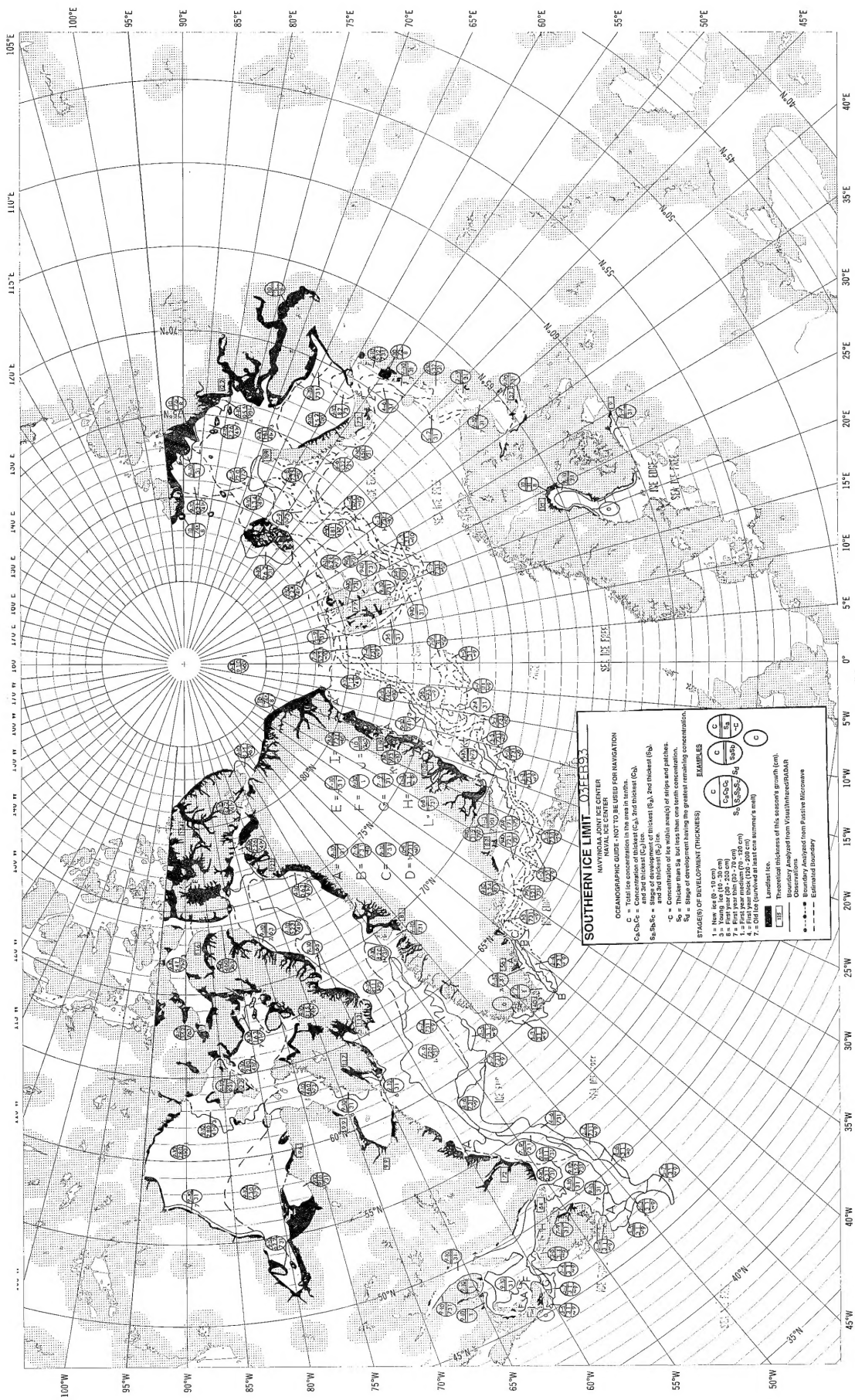
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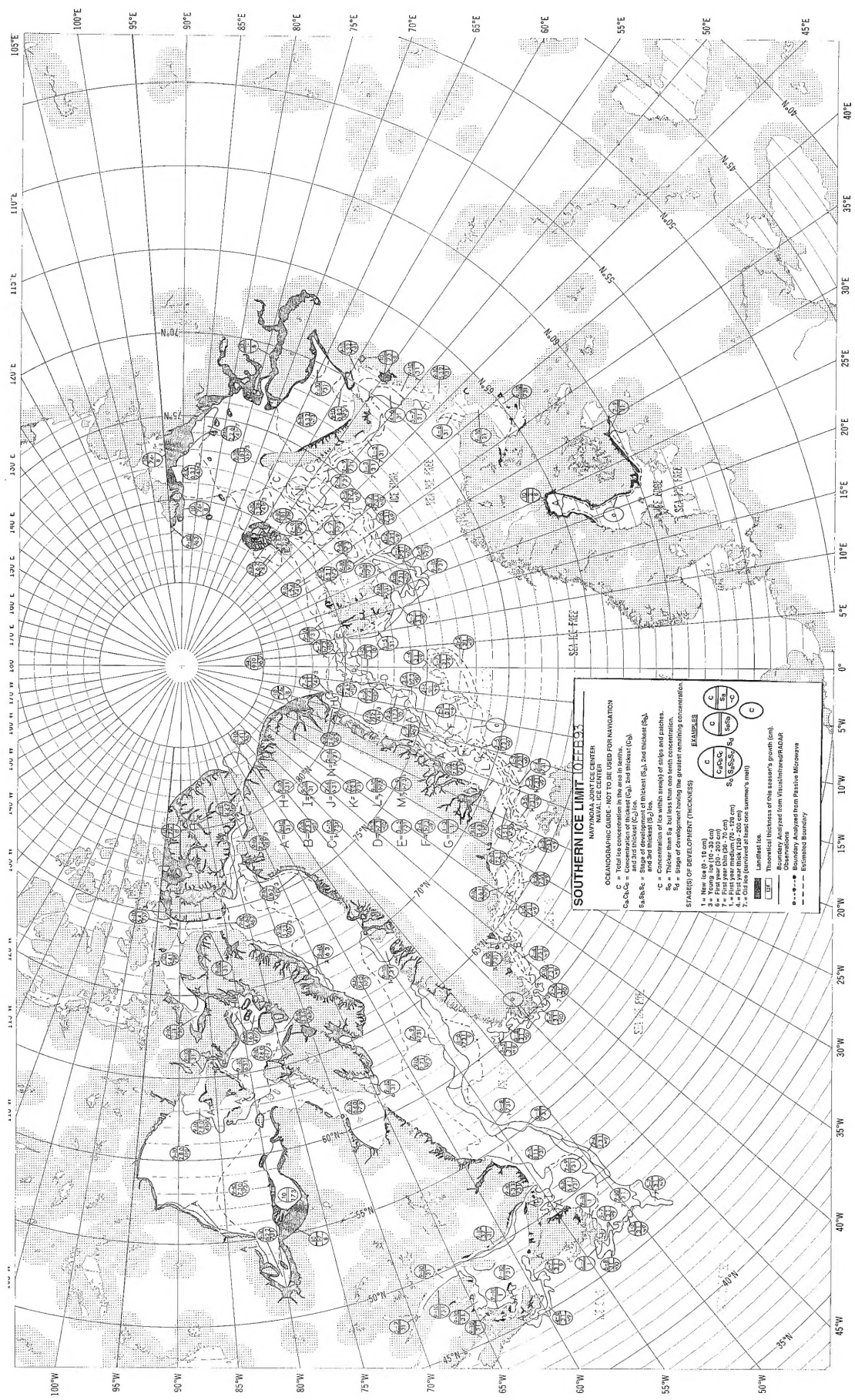
EXAMPLES

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79 = First year ice (7600-7700 cm)
80 = First year ice (7700-7800 cm)
81 = First year ice (7800-7900 cm)
82 = First year ice (7900-8000 cm)
83 = First year ice (8000-8100 cm)
84 = First year ice (8100-8200 cm)
85 = First year ice (8200-8300 cm)
86 = First year ice (8300-8400 cm)
87 = First year ice (8400-8500 cm)
88 = First year ice (8500-8600 cm)
89 = First year ice (8600-8700 cm)
90 = First year ice (8700-8800 cm)
91 = First year ice (8800-8900 cm)
92 = First year ice (8900-9000 cm)
93 = First year ice (9000-9100 cm)
94 = First year ice (9100-9200 cm)
95 = First year ice (9200-9300 cm)
96 = First year ice (9300-9400 cm)
97 = First year ice (9400-9500 cm)
98 = First year ice (9500-9600 cm)
99 = First year ice (9600-9700 cm)
100 = First year ice (9700-9800 cm)
101 = First year ice (9800-9900 cm)
102 = First year ice (9900-10000 cm)

LEGEND

Land ice
Boundary Analyzed from Visual Information
Boundary Analyzed from Passive Microwave
Estimated Boundary





SOUTHERN ICE LIMIT 1983
 NAVY ICE CENTER
 NAVAL ICE CENTER

OCEANOGRAPHIC GUIDE - NOT TO BE USED FOR NAVIGATION

C = Total ice concentration in the area in tenths.
 C₁ = First year (50-200 cm).
 C₂ = Second year (200-300 cm).
 C₃ = Third year (300-400 cm).
 C₄ = Fourth year (400-500 cm).
 C₅ = Fifth year (500-600 cm).
 C₆ = Sixth year (600-700 cm).
 C₇ = Seventh year (700-800 cm).
 C₈ = Eighth year (800-900 cm).
 C₉ = Ninth year (900-1000 cm).
 C₁₀ = Tenth year (1000-1100 cm).
 C₁₁ = Eleventh year (1100-1200 cm).
 C₁₂ = Twelfth year (1200-1300 cm).
 C₁₃ = Thirteenth year (1300-1400 cm).
 C₁₄ = Fourteenth year (1400-1500 cm).
 C₁₅ = Fifteenth year (1500-1600 cm).
 C₁₆ = Sixteenth year (1600-1700 cm).
 C₁₇ = Seventeenth year (1700-1800 cm).
 C₁₈ = Eighteenth year (1800-1900 cm).
 C₁₉ = Nineteenth year (1900-2000 cm).
 C₂₀ = Twentieth year (2000-2100 cm).
 C₂₁ = Twenty-first year (2100-2200 cm).
 C₂₂ = Twenty-second year (2200-2300 cm).
 C₂₃ = Twenty-third year (2300-2400 cm).
 C₂₄ = Twenty-fourth year (2400-2500 cm).
 C₂₅ = Twenty-fifth year (2500-2600 cm).
 C₂₆ = Twenty-sixth year (2600-2700 cm).
 C₂₇ = Twenty-seventh year (2700-2800 cm).
 C₂₈ = Twenty-eighth year (2800-2900 cm).
 C₂₉ = Twenty-ninth year (2900-3000 cm).
 C₃₀ = Thirtieth year (3000-3100 cm).
 C₃₁ = Thirty-first year (3100-3200 cm).
 C₃₂ = Thirty-second year (3200-3300 cm).
 C₃₃ = Thirty-third year (3300-3400 cm).
 C₃₄ = Thirty-fourth year (3400-3500 cm).
 C₃₅ = Thirty-fifth year (3500-3600 cm).
 C₃₆ = Thirty-sixth year (3600-3700 cm).
 C₃₇ = Thirty-seventh year (3700-3800 cm).
 C₃₈ = Thirty-eighth year (3800-3900 cm).
 C₃₉ = Thirty-ninth year (3900-4000 cm).
 C₄₀ = Fortieth year (4000-4100 cm).
 C₄₁ = Forty-first year (4100-4200 cm).
 C₄₂ = Forty-second year (4200-4300 cm).
 C₄₃ = Forty-third year (4300-4400 cm).
 C₄₄ = Forty-fourth year (4400-4500 cm).
 C₄₅ = Forty-fifth year (4500-4600 cm).
 C₄₆ = Forty-sixth year (4600-4700 cm).
 C₄₇ = Forty-seventh year (4700-4800 cm).
 C₄₈ = Forty-eighth year (4800-4900 cm).
 C₄₉ = Forty-ninth year (4900-5000 cm).
 C₅₀ = Fiftieth year (5000-5100 cm).
 C₅₁ = Fifty-first year (5100-5200 cm).
 C₅₂ = Fifty-second year (5200-5300 cm).
 C₅₃ = Fifty-third year (5300-5400 cm).
 C₅₄ = Fifty-fourth year (5400-5500 cm).
 C₅₅ = Fifty-fifth year (5500-5600 cm).
 C₅₆ = Fifty-sixth year (5600-5700 cm).
 C₅₇ = Fifty-seventh year (5700-5800 cm).
 C₅₈ = Fifty-eighth year (5800-5900 cm).
 C₅₉ = Fifty-ninth year (5900-6000 cm).
 C₆₀ = Sixtieth year (6000-6100 cm).
 C₆₁ = Sixty-first year (6100-6200 cm).
 C₆₂ = Sixty-second year (6200-6300 cm).
 C₆₃ = Sixty-third year (6300-6400 cm).
 C₆₄ = Sixty-fourth year (6400-6500 cm).
 C₆₅ = Sixty-fifth year (6500-6600 cm).
 C₆₆ = Sixty-sixth year (6600-6700 cm).
 C₆₇ = Sixty-seventh year (6700-6800 cm).
 C₆₈ = Sixty-eighth year (6800-6900 cm).
 C₆₉ = Sixty-ninth year (6900-7000 cm).
 C₇₀ = Seventieth year (7000-7100 cm).
 C₇₁ = Seventy-first year (7100-7200 cm).
 C₇₂ = Seventy-second year (7200-7300 cm).
 C₇₃ = Seventy-third year (7300-7400 cm).
 C₇₄ = Seventy-fourth year (7400-7500 cm).
 C₇₅ = Seventy-fifth year (7500-7600 cm).
 C₇₆ = Seventy-sixth year (7600-7700 cm).
 C₇₇ = Seventy-seventh year (7700-7800 cm).
 C₇₈ = Seventy-eighth year (7800-7900 cm).
 C₇₉ = Seventy-ninth year (7900-8000 cm).
 C₈₀ = Eightieth year (8000-8100 cm).
 C₈₁ = Eighty-first year (8100-8200 cm).
 C₈₂ = Eighty-second year (8200-8300 cm).
 C₈₃ = Eighty-third year (8300-8400 cm).
 C₈₄ = Eighty-fourth year (8400-8500 cm).
 C₈₅ = Eighty-fifth year (8500-8600 cm).
 C₈₆ = Eighty-sixth year (8600-8700 cm).
 C₈₇ = Eighty-seventh year (8700-8800 cm).
 C₈₈ = Eighty-eighth year (8800-8900 cm).
 C₈₉ = Eighty-ninth year (8900-9000 cm).
 C₉₀ = Ninetieth year (9000-9100 cm).
 C₉₁ = Ninety-first year (9100-9200 cm).
 C₉₂ = Ninety-second year (9200-9300 cm).
 C₉₃ = Ninety-third year (9300-9400 cm).
 C₉₄ = Ninety-fourth year (9400-9500 cm).
 C₉₅ = Ninety-fifth year (9500-9600 cm).
 C₉₆ = Ninety-sixth year (9600-9700 cm).
 C₉₇ = Ninety-seventh year (9700-9800 cm).
 C₉₈ = Ninety-eighth year (9800-9900 cm).
 C₉₉ = Ninety-ninth year (9900-10000 cm).
 C₁₀₀ = One hundredth year (10000-10100 cm).

STAGES OF DEVELOPMENT (THICKNESS)

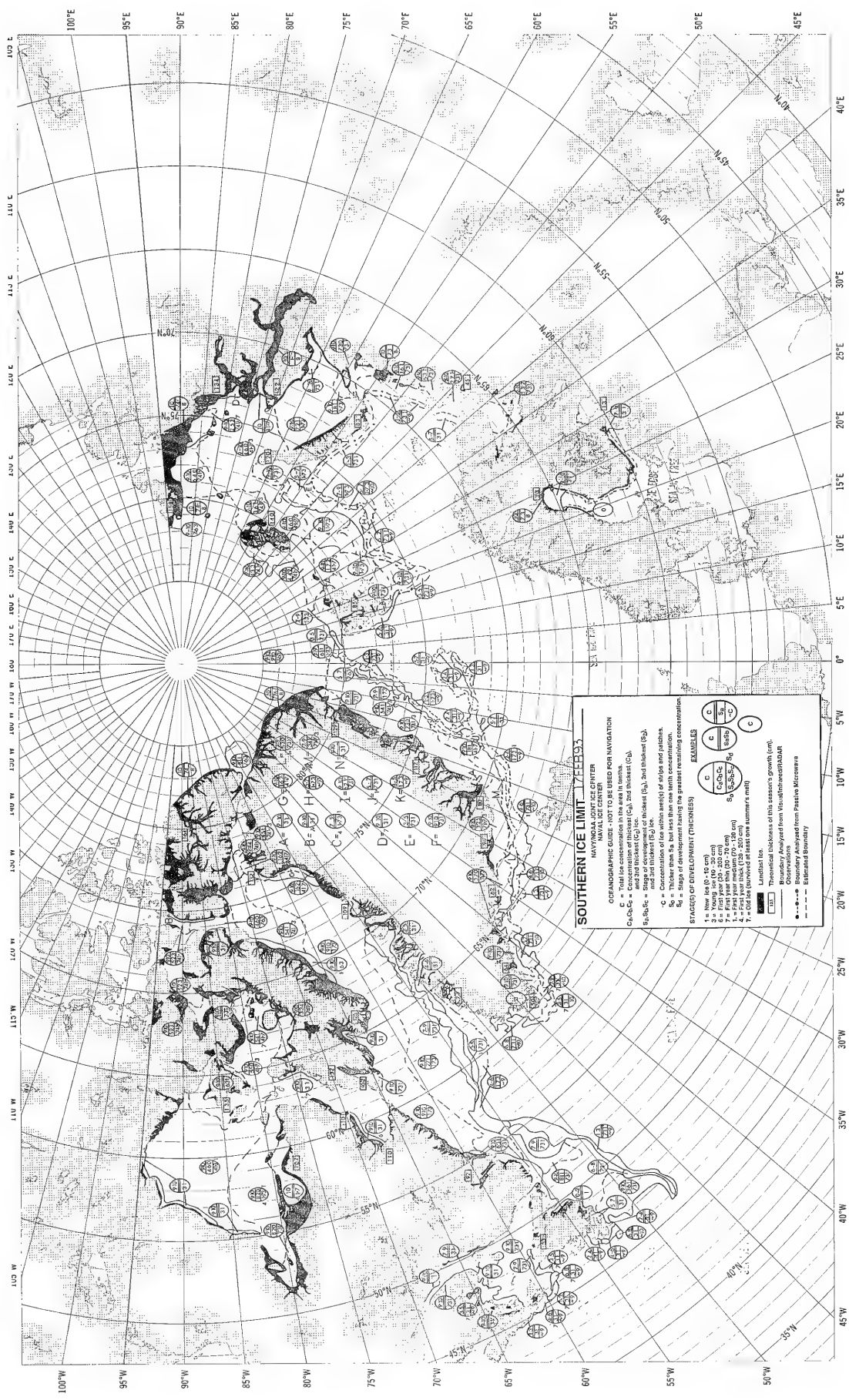
1 = New ice (0-20 cm).
 2 = First year (20-30 cm).
 3 = First year (30-40 cm).
 4 = First year (40-50 cm).
 5 = First year (50-60 cm).
 6 = First year (60-70 cm).
 7 = First year (70-80 cm).
 8 = First year (80-90 cm).
 9 = First year (90-100 cm).
 10 = First year (100-110 cm).
 11 = First year (110-120 cm).
 12 = First year (120-130 cm).
 13 = First year (130-140 cm).
 14 = First year (140-150 cm).
 15 = First year (150-160 cm).
 16 = First year (160-170 cm).
 17 = First year (170-180 cm).
 18 = First year (180-190 cm).
 19 = First year (190-200 cm).
 20 = First year (200-210 cm).
 21 = First year (210-220 cm).
 22 = First year (220-230 cm).
 23 = First year (230-240 cm).
 24 = First year (240-250 cm).
 25 = First year (250-260 cm).
 26 = First year (260-270 cm).
 27 = First year (270-280 cm).
 28 = First year (280-290 cm).
 29 = First year (290-300 cm).
 30 = First year (300-310 cm).
 31 = First year (310-320 cm).
 32 = First year (320-330 cm).
 33 = First year (330-340 cm).
 34 = First year (340-350 cm).
 35 = First year (350-360 cm).
 36 = First year (360-370 cm).
 37 = First year (370-380 cm).
 38 = First year (380-390 cm).
 39 = First year (390-400 cm).
 40 = First year (400-410 cm).
 41 = First year (410-420 cm).
 42 = First year (420-430 cm).
 43 = First year (430-440 cm).
 44 = First year (440-450 cm).
 45 = First year (450-460 cm).
 46 = First year (460-470 cm).
 47 = First year (470-480 cm).
 48 = First year (480-490 cm).
 49 = First year (490-500 cm).
 50 = First year (500-510 cm).
 51 = First year (510-520 cm).
 52 = First year (520-530 cm).
 53 = First year (530-540 cm).
 54 = First year (540-550 cm).
 55 = First year (550-560 cm).
 56 = First year (560-570 cm).
 57 = First year (570-580 cm).
 58 = First year (580-590 cm).
 59 = First year (590-600 cm).
 60 = First year (600-610 cm).
 61 = First year (610-620 cm).
 62 = First year (620-630 cm).
 63 = First year (630-640 cm).
 64 = First year (640-650 cm).
 65 = First year (650-660 cm).
 66 = First year (660-670 cm).
 67 = First year (670-680 cm).
 68 = First year (680-690 cm).
 69 = First year (690-700 cm).
 70 = First year (700-710 cm).
 71 = First year (710-720 cm).
 72 = First year (720-730 cm).
 73 = First year (730-740 cm).
 74 = First year (740-750 cm).
 75 = First year (750-760 cm).
 76 = First year (760-770 cm).
 77 = First year (770-780 cm).
 78 = First year (780-790 cm).
 79 = First year (790-800 cm).
 80 = First year (800-810 cm).
 81 = First year (810-820 cm).
 82 = First year (820-830 cm).
 83 = First year (830-840 cm).
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 87 = First year (870-880 cm).
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 90 = First year (900-910 cm).
 91 = First year (910-920 cm).
 92 = First year (920-930 cm).
 93 = First year (930-940 cm).
 94 = First year (940-950 cm).
 95 = First year (950-960 cm).
 96 = First year (960-970 cm).
 97 = First year (970-980 cm).
 98 = First year (980-990 cm).
 99 = First year (990-1000 cm).
 100 = First year (1000-1010 cm).

EXAMPLES

1. New ice (0-20 cm).
 2. First year (20-30 cm).
 3. First year (30-40 cm).
 4. First year (40-50 cm).
 5. First year (50-60 cm).
 6. First year (60-70 cm).
 7. First year (70-80 cm).
 8. First year (80-90 cm).
 9. First year (90-100 cm).
 10. First year (100-110 cm).
 11. First year (110-120 cm).
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 16. First year (160-170 cm).
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 27. First year (270-280 cm).
 28. First year (280-290 cm).
 29. First year (290-300 cm).
 30. First year (300-310 cm).
 31. First year (310-320 cm).
 32. First year (320-330 cm).
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 34. First year (340-350 cm).
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 37. First year (370-380 cm).
 38. First year (380-390 cm).
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 93. First year (930-940 cm).
 94. First year (940-950 cm).
 95. First year (950-960 cm).
 96. First year (960-970 cm).
 97. First year (970-980 cm).
 98. First year (980-990 cm).
 99. First year (990-1000 cm).
 100. First year (1000-1010 cm).

Legend

Landfast ice.
 Theoretical thickness of the season's growth (cm).
 Boundary Analyzed from Visual Reconnaissance.
 Boundary Analyzed from Passive Microwave.
 Estimated Boundary.



SOUTHERN ICE LIMIT
 NAVY AND NAVAL CENTER
 NAVAL ICE CENTER

OCEANOGRAPHIC GUIDE - NOT TO BE USED FOR NAVIGATION

C = Total ice concentration in the area in tenths.
 C₁C₂C₃ = Stages of development of thickest (C₁), and thickest (C₂), and thickest (C₃) ice.
 S₁S₂S₃ = Stages of development of thickest (S₁), and thickest (S₂), and thickest (S₃) ice.
 S₄ = Thicker than S₃, but less than one tenth concentration.
 S₅ = Concentration of ice within area(s) of stripes and patches.
 S₆ = Concentration of ice within area(s) of stripes and patches.
 S₇ = Stages of development having the greatest remaining concentration.

STAGES OF DEVELOPMENT (THICKNESS)

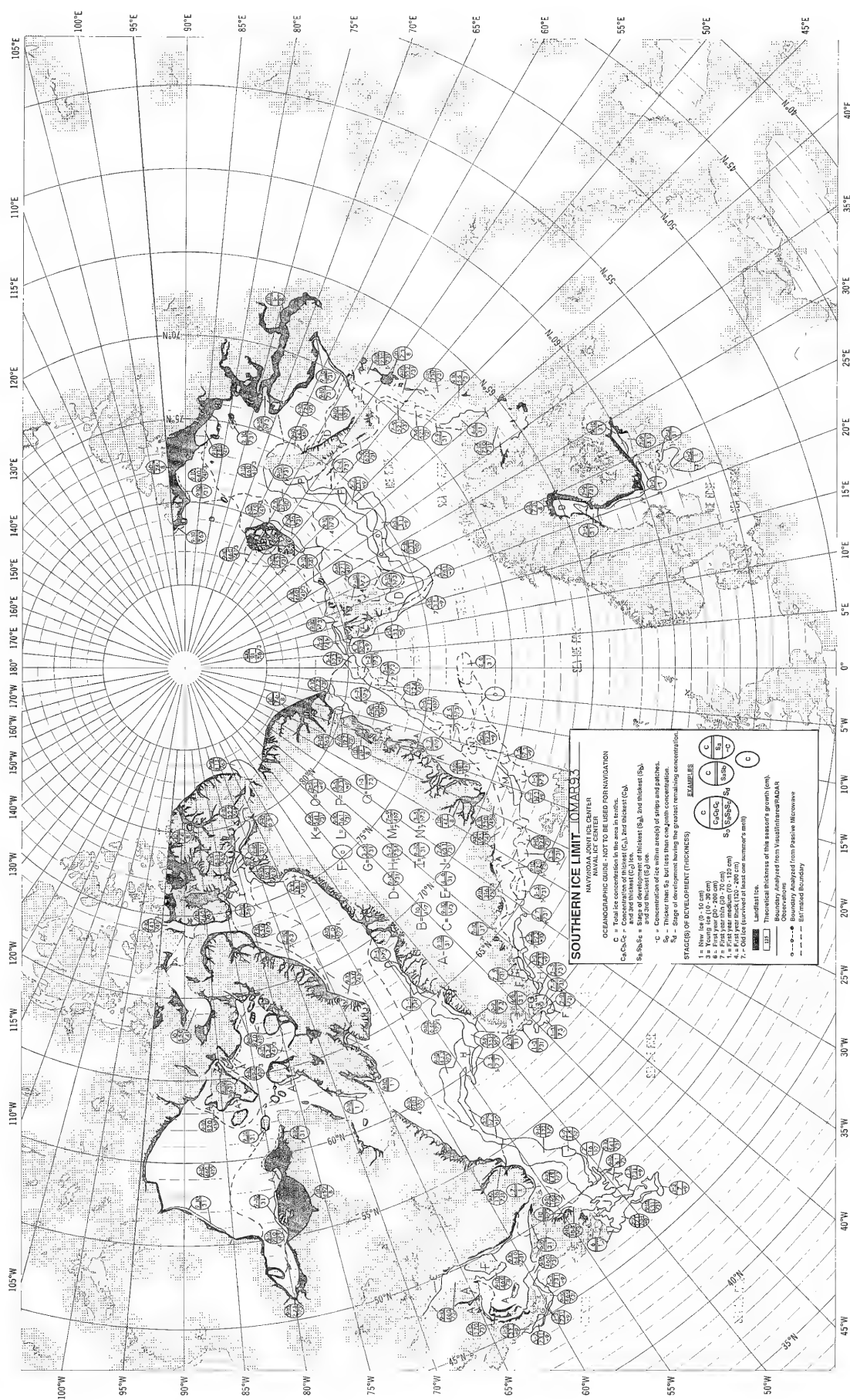
1 = New ice (0-10 cm)
 2 = First year ice (10-20 cm)
 3 = First year ice (20-30 cm)
 4 = First year ice (30-40 cm)
 5 = First year ice (40-50 cm)
 6 = First year ice (50-60 cm)
 7 = Old ice (60-70 cm)
 8 = Old ice (70-80 cm)
 9 = Old ice (80-90 cm)
 10 = Old ice (90-100 cm)

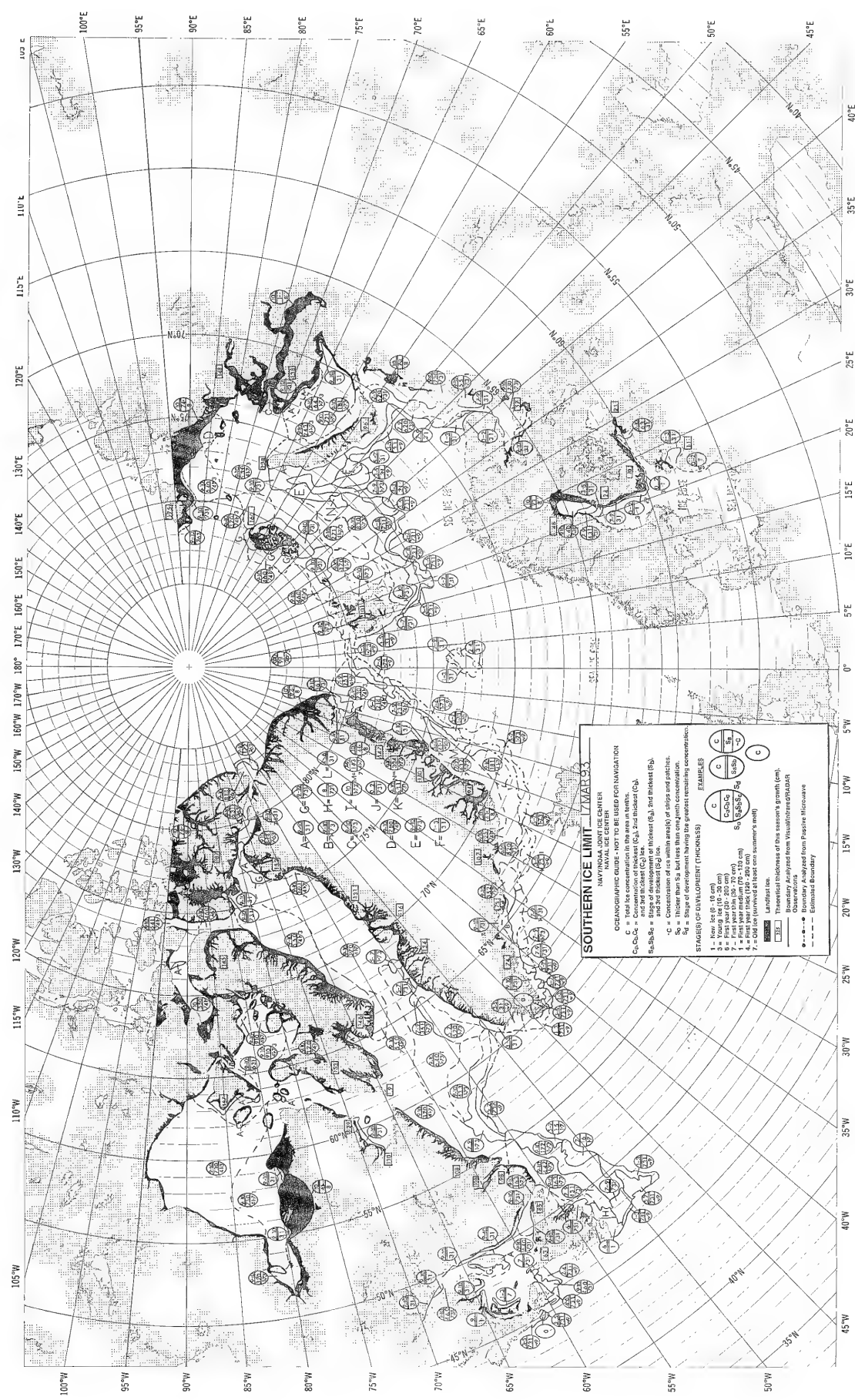
EXAMPLES

1. New ice (0-10 cm)
 2. First year ice (10-20 cm)
 3. First year ice (20-30 cm)
 4. First year ice (30-40 cm)
 5. First year ice (40-50 cm)
 6. First year ice (50-60 cm)
 7. Old ice (60-70 cm)
 8. Old ice (70-80 cm)
 9. Old ice (80-90 cm)
 10. Old ice (90-100 cm)

Legend:

Landline ice
 Boundary Analyzed from Visual Observations
 Boundary Analyzed from Passive Microwave
 Estimated Boundary





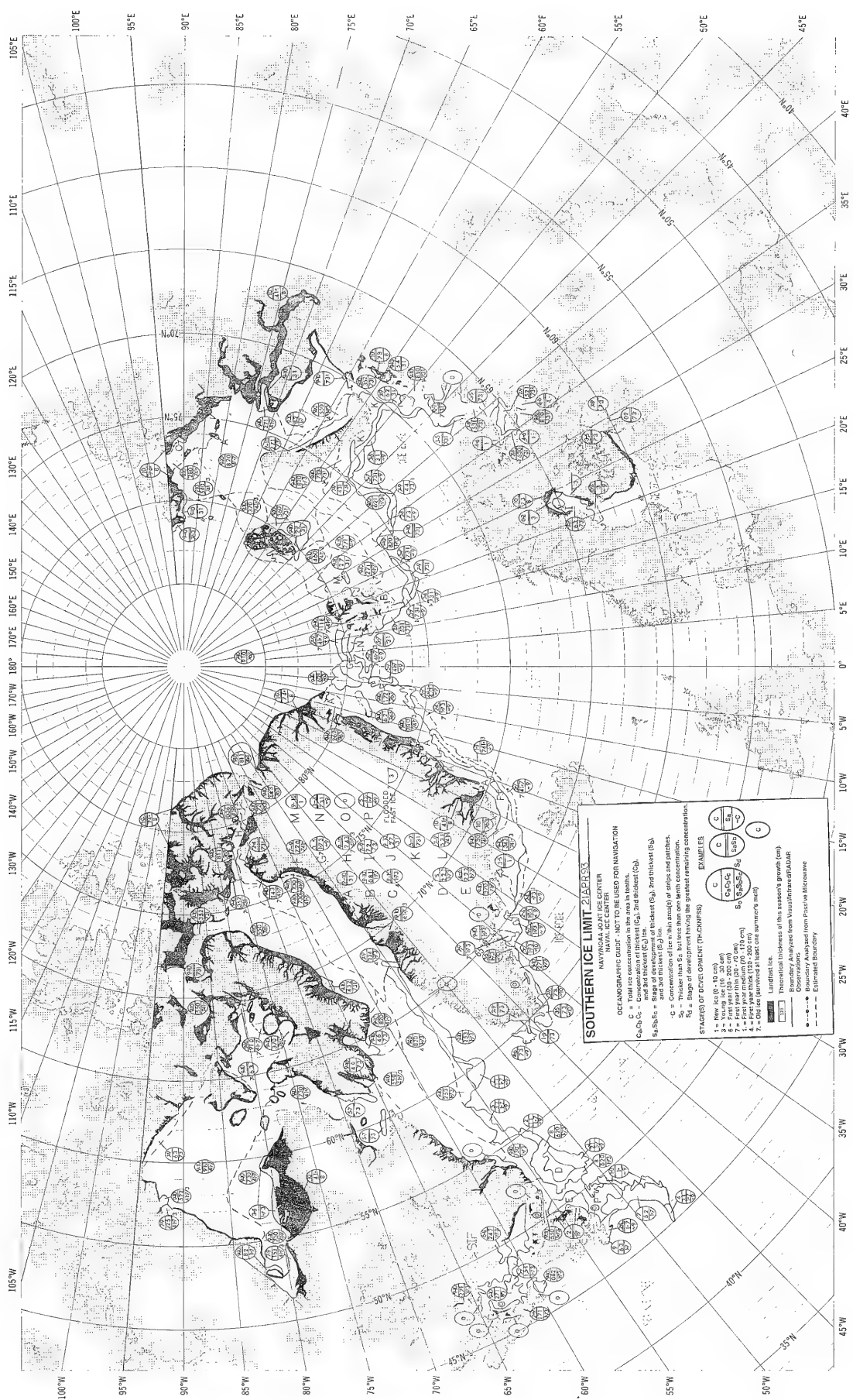
SOUTHERN ICE LIMIT - 17 MAR 53
 NAVY/NASA JOINT ICE CENTER
 NAVAL ICE CENTER

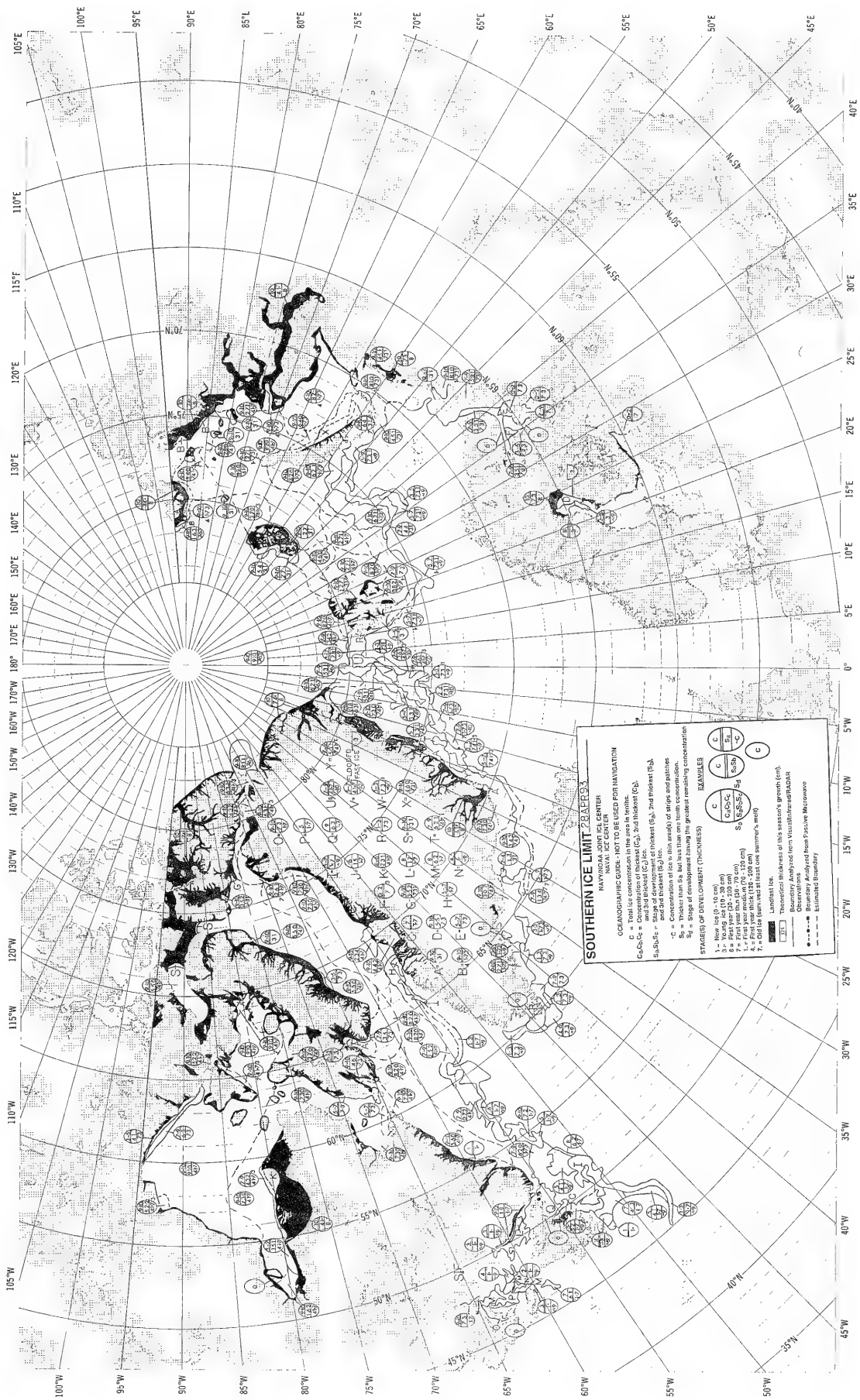
SYMBOLS
 C = Concentration of ice within area of ships and parties.
 C₁C₂C₃ = Concentration of thickest (C₁), 2nd thickest (C₂), and 3rd thickest (C₃) ice.
 R₁R₂R₃ = Stage of development having the greatest remaining concentration.
 R₁ = Stage of development having the greatest remaining concentration.
 R₂ = Stage of development having the greatest remaining concentration.
 R₃ = Stage of development having the greatest remaining concentration.

STAGES OF DEVELOPMENT (THICKNESS)
 1 = New ice (0 - 10 cm)
 2 = Young ice (10 - 30 cm)
 3 = First year ice (30 - 70 cm)
 4 = First year ice (70 - 100 cm)
 5 = First year ice (100 - 150 cm)
 6 = First year ice (150 - 200 cm)
 7 = Old ice (200 cm or more)

EXAMPLES
 C₁C₂C₃ = C₁C₂C₃
 R₁R₂R₃ = R₁R₂R₃
 S₁S₂S₃ = S₁S₂S₃

Legend
 Landfast ice
 Thickness of ice (cm)
 100-150
 150-200
 200-250
 250-300
 300-350
 350-400
 400-450
 450-500
 500-550
 550-600
 600-650
 650-700
 700-750
 750-800
 800-850
 850-900
 900-950
 950-1000
 1000-1050
 1050-1100
 1100-1150
 1150-1200
 1200-1250
 1250-1300
 1300-1350
 1350-1400
 1400-1450
 1450-1500
 1500-1550
 1550-1600
 1600-1650
 1650-1700
 1700-1750
 1750-1800
 1800-1850
 1850-1900
 1900-1950
 1950-2000
 2000-2050
 2050-2100
 2100-2150
 2150-2200
 2200-2250
 2250-2300
 2300-2350
 2350-2400
 2400-2450
 2450-2500
 2500-2550
 2550-2600
 2600-2650
 2650-2700
 2700-2750
 2750-2800
 2800-2850
 2850-2900
 2900-2950
 2950-3000
 3000-3050
 3050-3100
 3100-3150
 3150-3200
 3200-3250
 3250-3300
 3300-3350
 3350-3400
 3400-3450
 3450-3500
 3500-3550
 3550-3600
 3600-3650
 3650-3700
 3700-3750
 3750-3800
 3800-3850
 3850-3900
 3900-3950
 3950-4000
 4000-4050
 4050-4100
 4100-4150
 4150-4200
 4200-4250
 4250-4300
 4300-4350
 4350-4400
 4400-4450
 4450-4500
 4500-4550
 4550-4600
 4600-4650
 4650-4700
 4700-4750
 4750-4800
 4800-4850
 4850-4900
 4900-4950
 4950-5000
 5000-5050
 5050-5100
 5100-5150
 5150-5200
 5200-5250
 5250-5300
 5300-5350
 5350-5400
 5400-5450
 5450-5500
 5500-5550
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 5950-6000
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 6100-6150
 6150-6200
 6200-6250
 6250-6300
 6300-6350
 6350-6400
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 6650-6700
 6700-6750
 6750-6800
 6800-6850
 6850-6900
 6900-6950
 6950-7000
 7000-7050
 7050-7100
 7100-7150
 7150-7200
 7200-7250
 7250-7300
 7300-7350
 7350-7400
 7400-7450
 7450-7500
 7500-7550
 7550-7600
 7600-7650
 7650-7700
 7700-7750
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 7850-7900
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 7950-8000
 8000-8050
 8050-8100
 8100-8150
 8150-8200
 8200-8250
 8250-8300
 8300-8350
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 8800-8850
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 8950-9000
 9000-9050
 9050-9100
 9100-9150
 9150-9200
 9200-9250
 9250-9300
 9300-9350
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 9400-9450
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 9950-10000
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 10050-10100
 10100-10150
 10150-10200
 10200-10250
 10250-10300
 10300-10350
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 10450-10500
 10500-10550
 10550-10600
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 12750-12800
 12800-12850
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 13450-13500
 13500-13550
 13550-13600
 13600-13650
 13650-13700
 13700-13750
 13750-13800
 13800-13850
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 13900-13950
 13950-14000
 14000-14050
 14050-14100
 14100-14150
 14150-14200
 14200-14250
 14250-14300
 14300-14350
 14350-14400
 14400-14450
 14450-14500
 14500-14550
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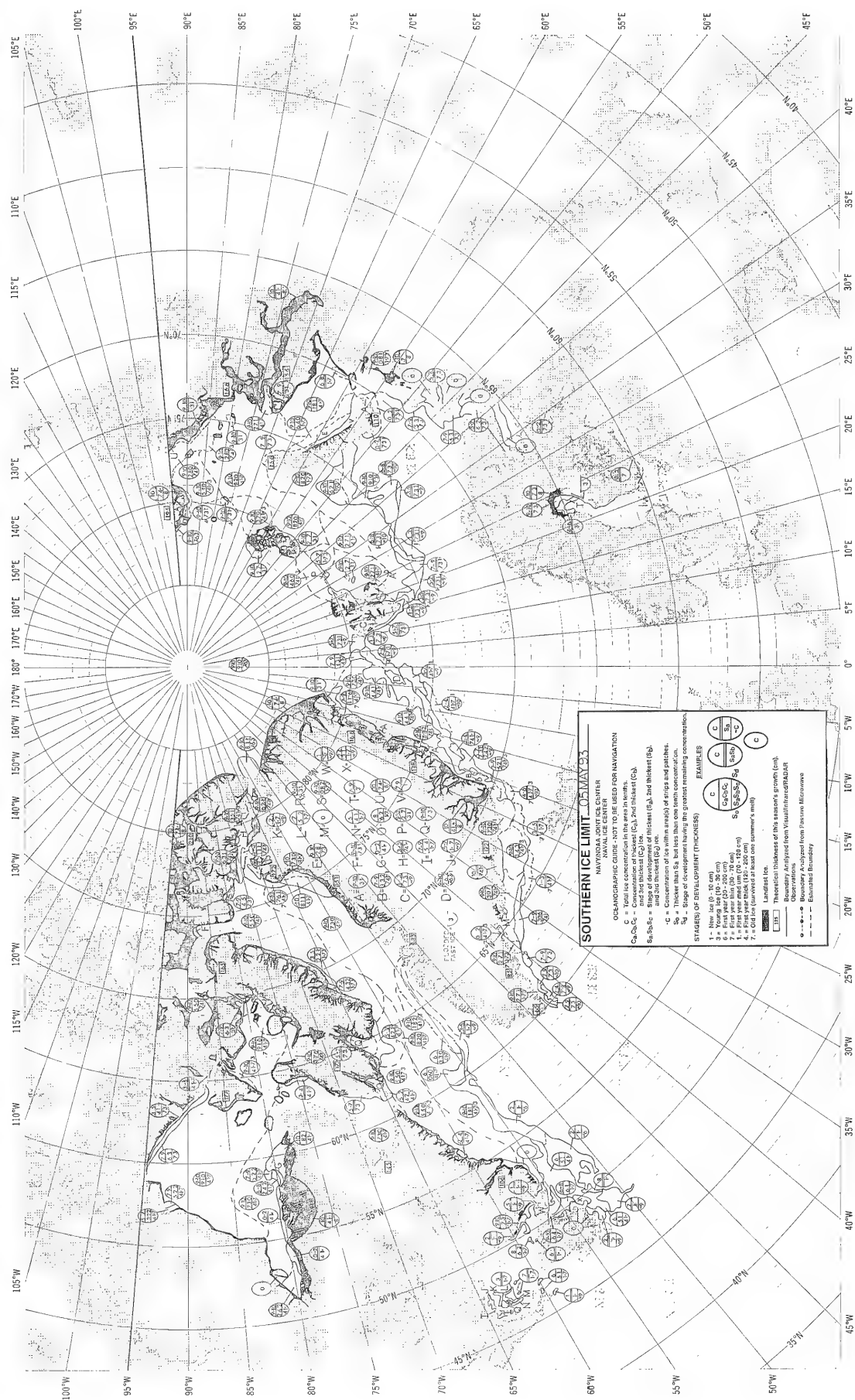
SOUTHERN ICE LIMIT 2000
NAVY/NOAA JOINT ICE CENTER

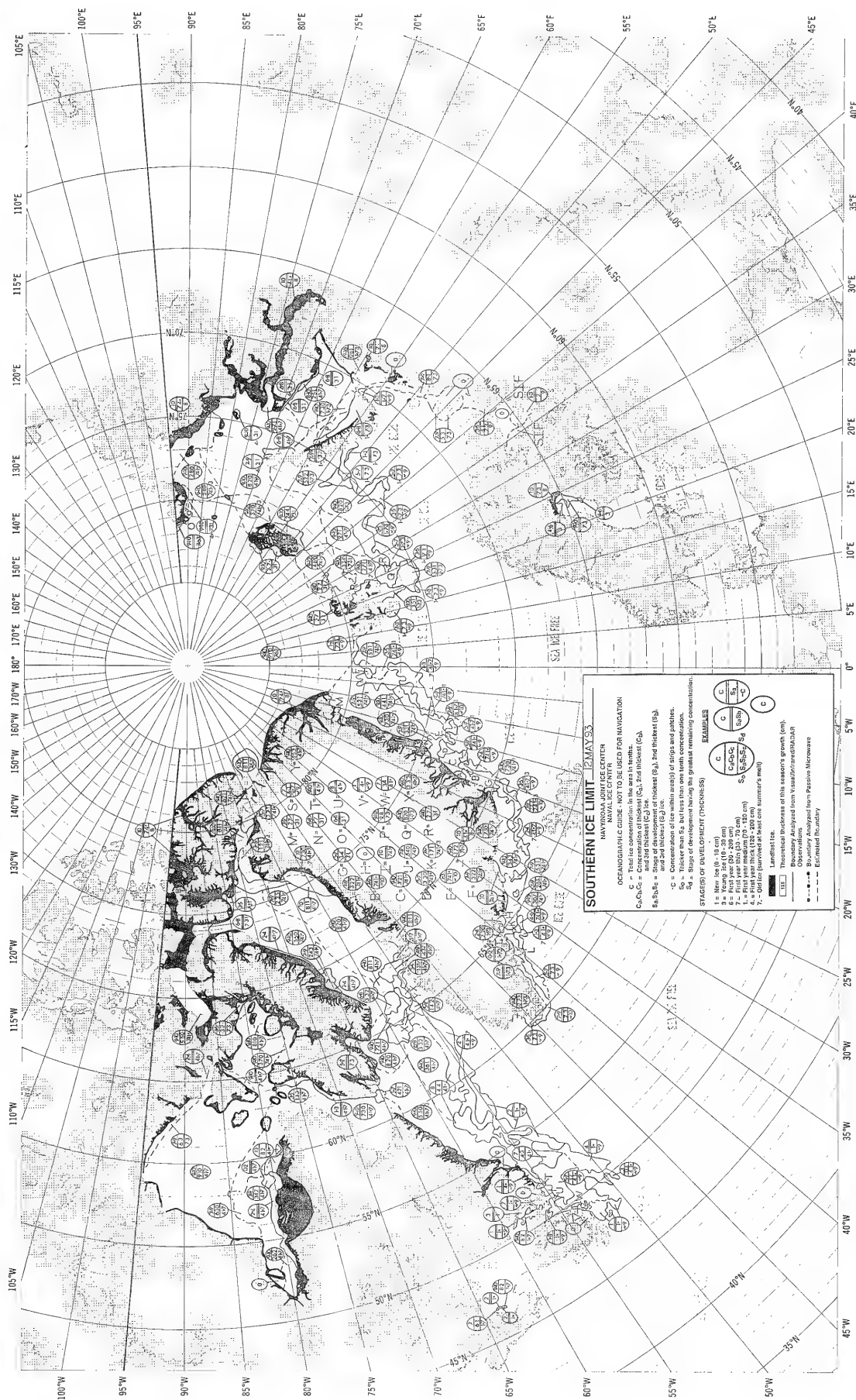
ICE CONCENTRATION
C = Total ice concentration in the area in tenths.
C₁, C₂, C₃ = Concentrations of thickest (C₁), and thickest (C₂), and thickest (C₃) ice.
S₁, S₂, S₃ = Stages of development of thickest (S₁), and thickest (S₂), and thickest (S₃) ice.
C₁, C₂, C₃ = Concentrations of ice in the area in tenths.
S₁, S₂, S₃ = Stages of development of ice in the area in tenths.

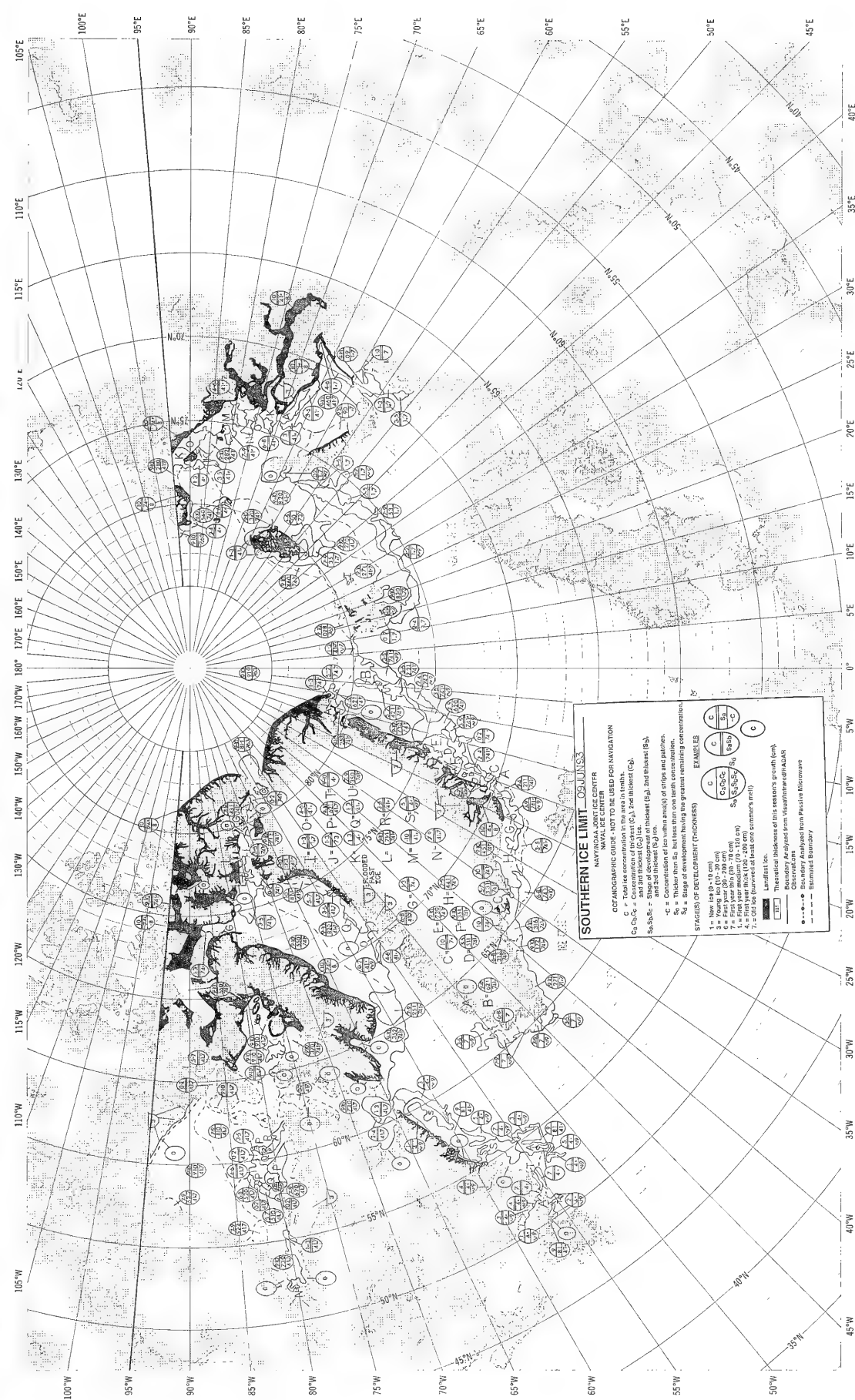
STAGES OF DEVELOPMENT (THICKNESS)
1 = New ice (0 - 10 cm)
2 = Young ice (10 - 20 cm)
3 = First year ice (20 - 30 cm)
4 = First year ice (30 - 40 cm)
5 = First year ice (40 - 50 cm)
6 = First year ice (50 - 60 cm)
7 = Old ice (60 cm and thicker)

EXAMPLES
C₁ C₂ C₃
S₁ S₂ S₃

LEGEND
Landfast ice
Boundary Analyzed from Visible Infrared RADIAR
Observations
Boundary Analyzed from Visible Microwave
Estimated Boundary







SOUTHERN ICE LIMIT - OBSUNES
NAVY/NOAA JOINT ICE CENTER

OFFICERS/NAVIGATORS - NOT TO BE USED FOR NAVIGATION

C = Total ice concentration in the area in tenths.
 C_1, C_2, C_3 = Concentration of thickest (C_1), 2nd thickest (C_2), and 3rd thickest (C_3) ice.
 S_1, S_2, S_3 = Stage of development of thickest (S_1), 2nd thickest (S_2), and 3rd thickest (S_3) ice.
 C = Concentration of ice in the area in tenths.
 S = Stage of development of ice in the area in tenths.
 S₁ = Stage of development having the greatest remaining concentration.
 S₂ = Stage of development having the next greatest remaining concentration.
 S₃ = Stage of development having the least remaining concentration.

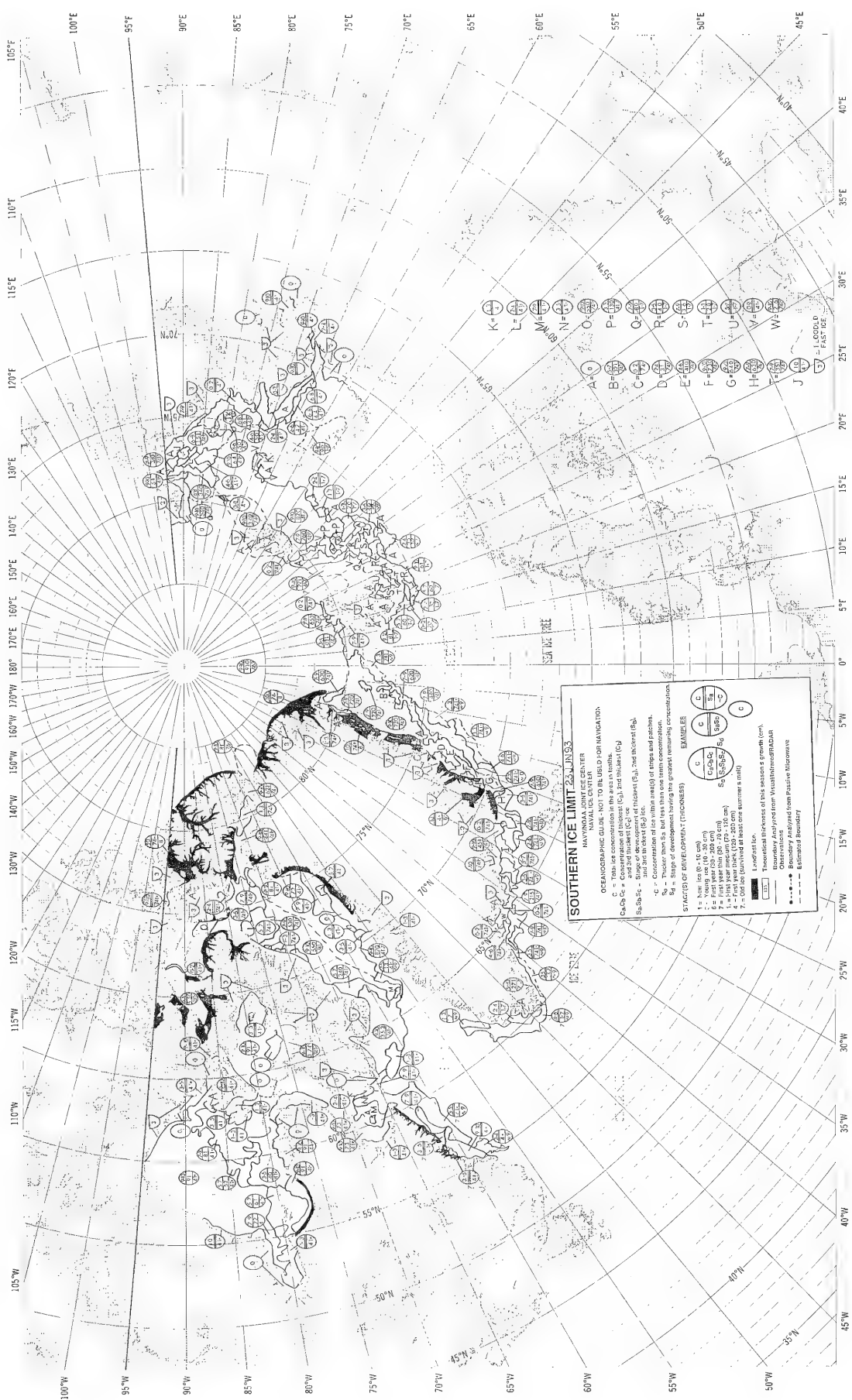
STAGES OF DEVELOPMENT (THICKNESS)

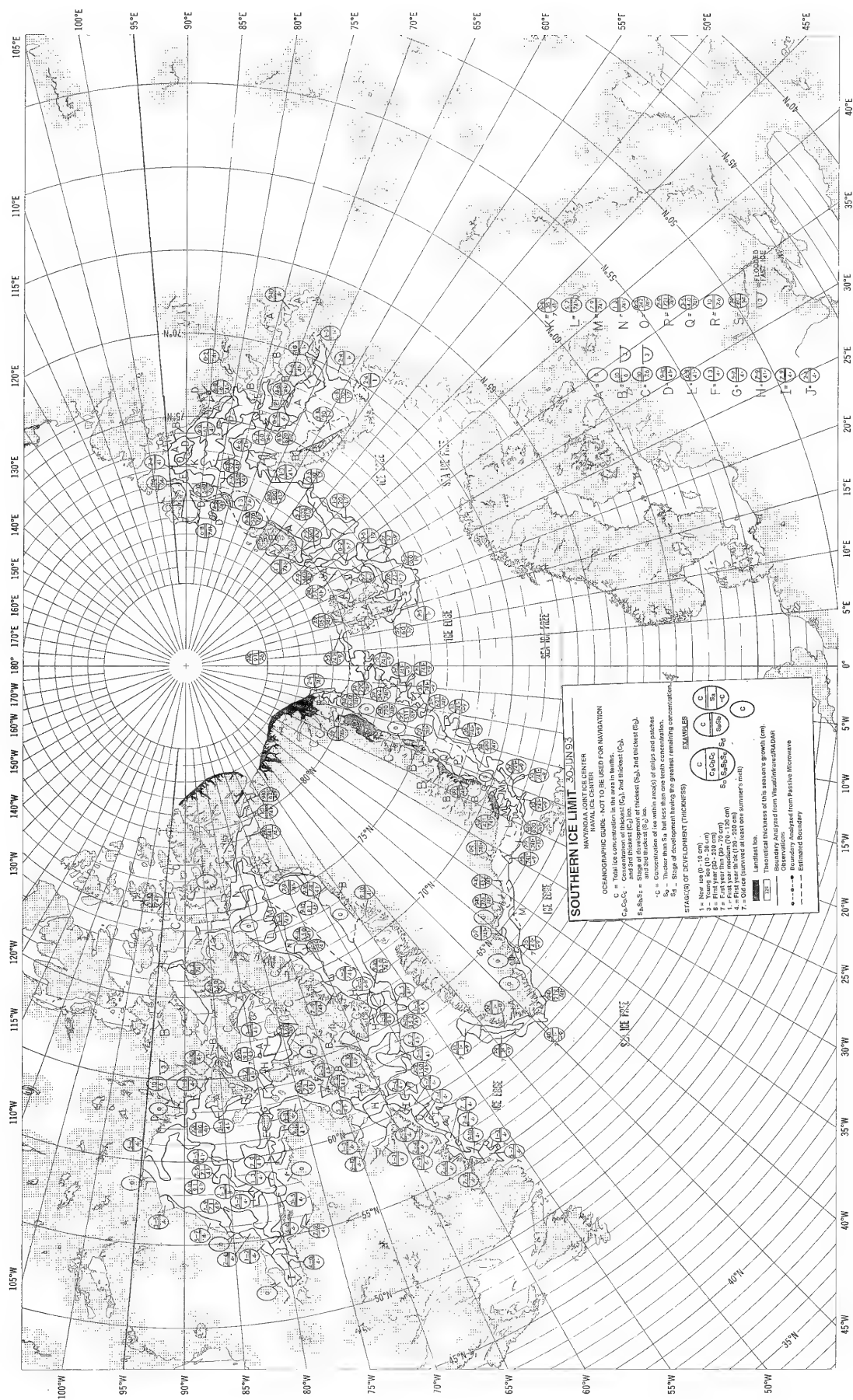
1 = New ice (0-10 cm)
 2 = Young ice (10-30 cm)
 3 = First year ice (30-70 cm)
 4 = First year ice (70-100 cm)
 5 = First year ice (100-150 cm)
 6 = First year ice (150-200 cm)
 7 = Old ice (200 cm or more)

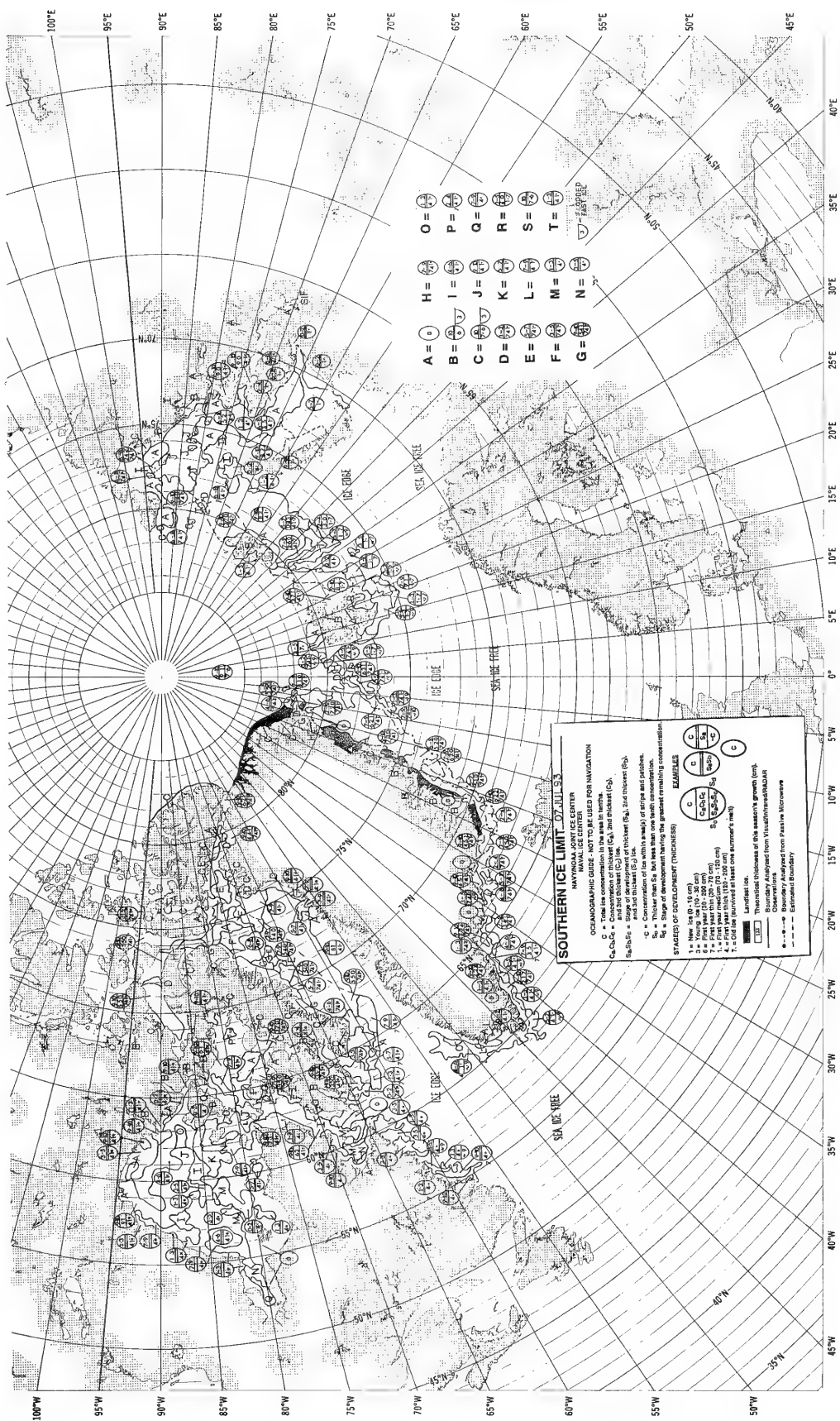
EXAMPLES

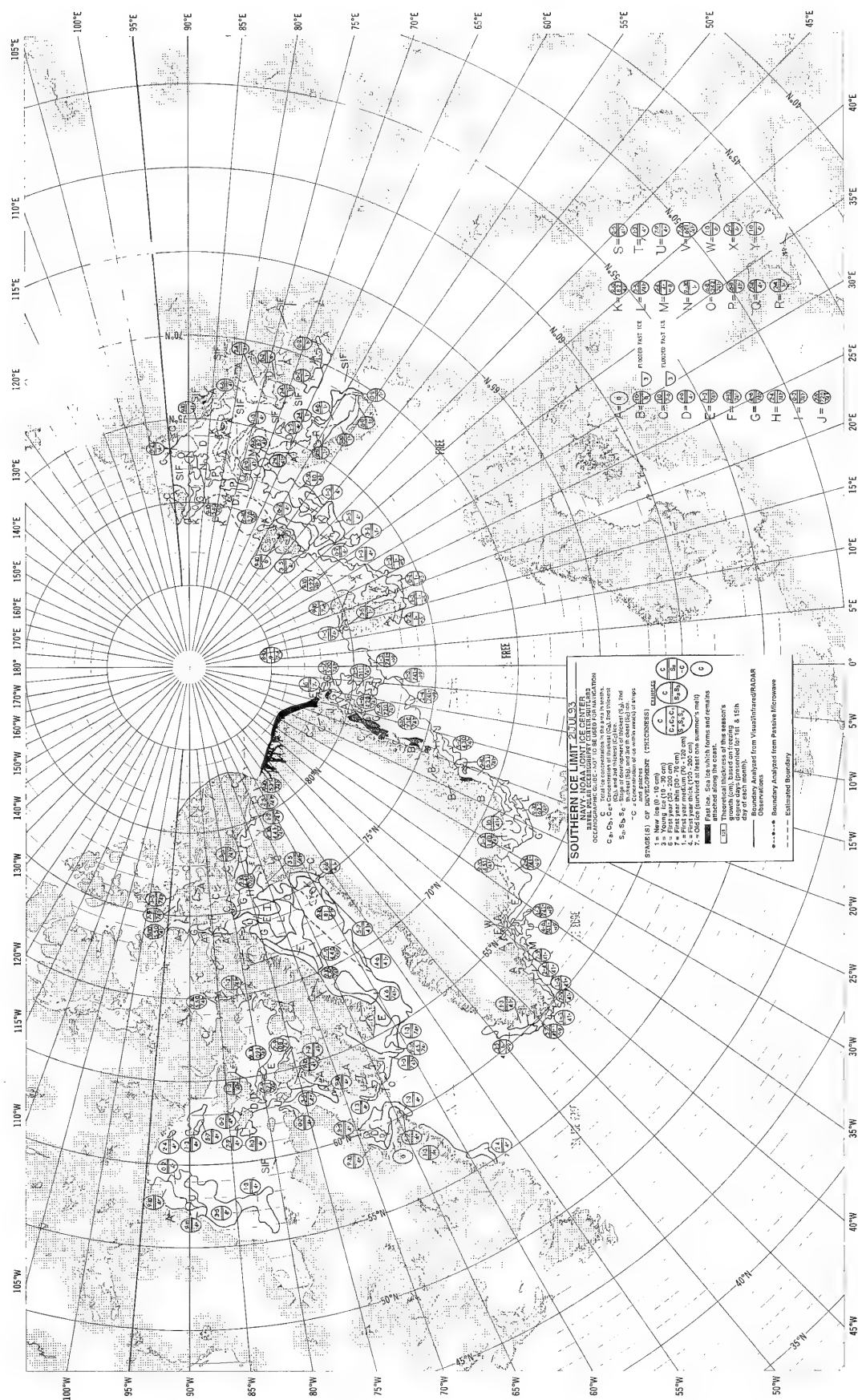
C	C ₁	C ₂	C ₃
5	3	2	1

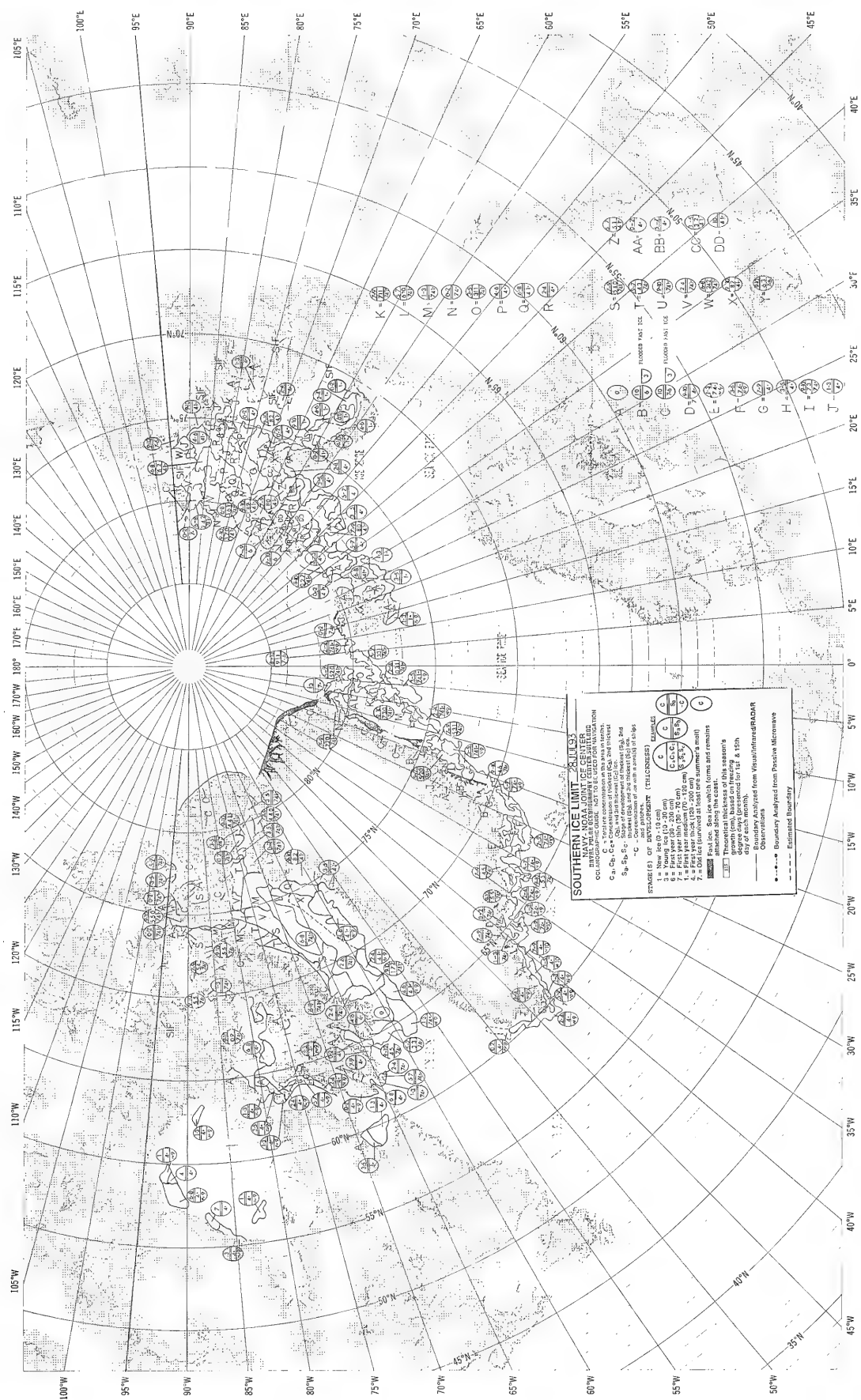
Landfast ice
 Sea ice
 Iceberg
 Ice field
 Ice pack
 Ice drift
 Ice edge
 Ice boundary
 Ice limit
 Ice concentration
 Ice stage
 Ice thickness
 Ice type
 Ice age
 Ice color
 Ice texture
 Ice shape
 Ice size
 Ice weight
 Ice volume
 Ice area
 Ice length
 Ice width
 Ice height
 Ice depth
 Ice density
 Ice buoyancy
 Ice strength
 Ice durability
 Ice flexibility
 Ice compressibility
 Ice permeability
 Ice conductivity
 Ice reflectivity
 Ice absorptivity
 Ice emissivity
 Ice transmissivity
 Ice refractivity
 Ice diffusivity
 Ice viscosity
 Ice elasticity
 Ice plasticity
 Ice brittleness
 Ice toughness
 Ice hardness
 Ice softness
 Ice malleability
 Ice ductility
 Ice tenacity
 Ice adhesion
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 Ice cohesion

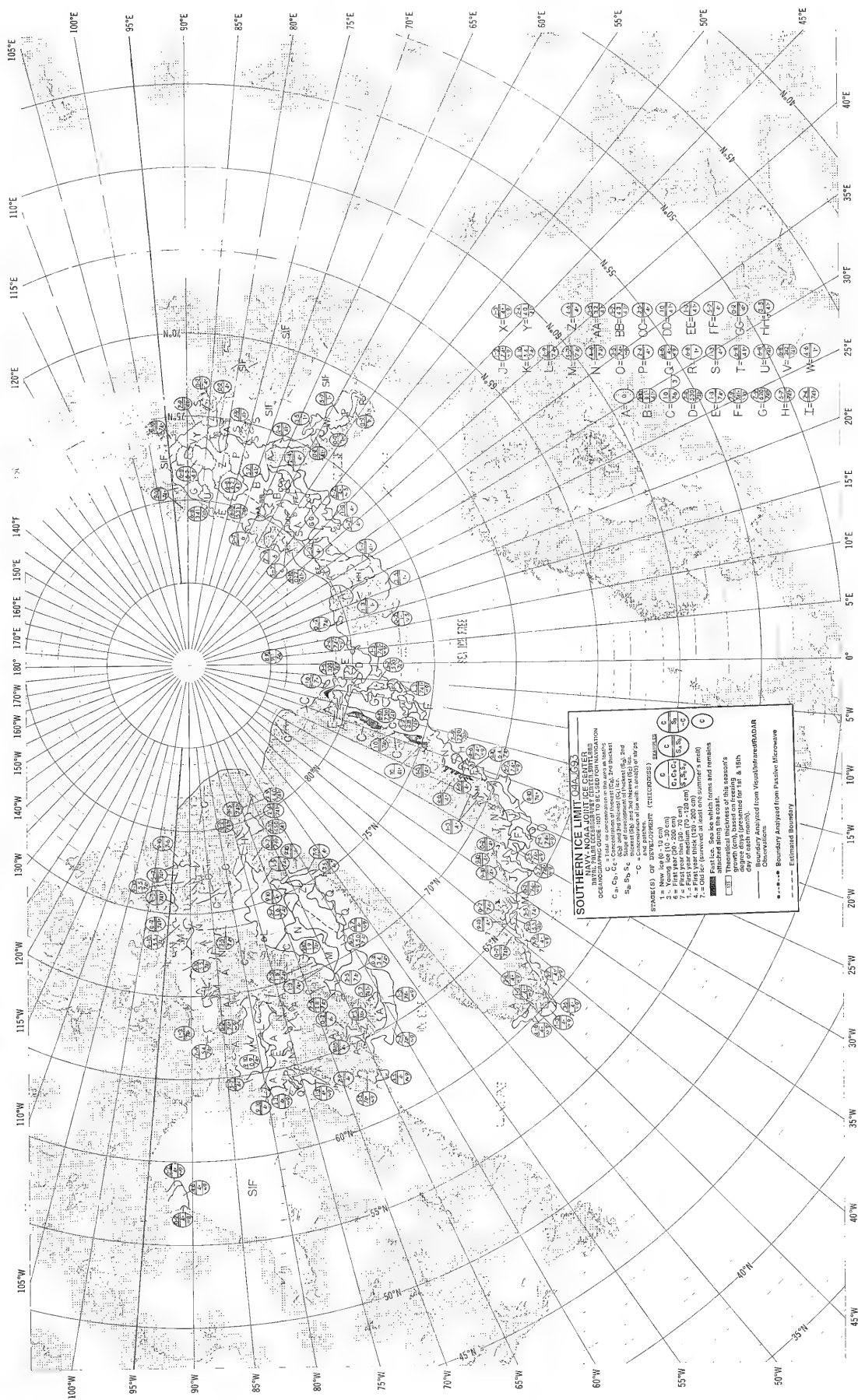


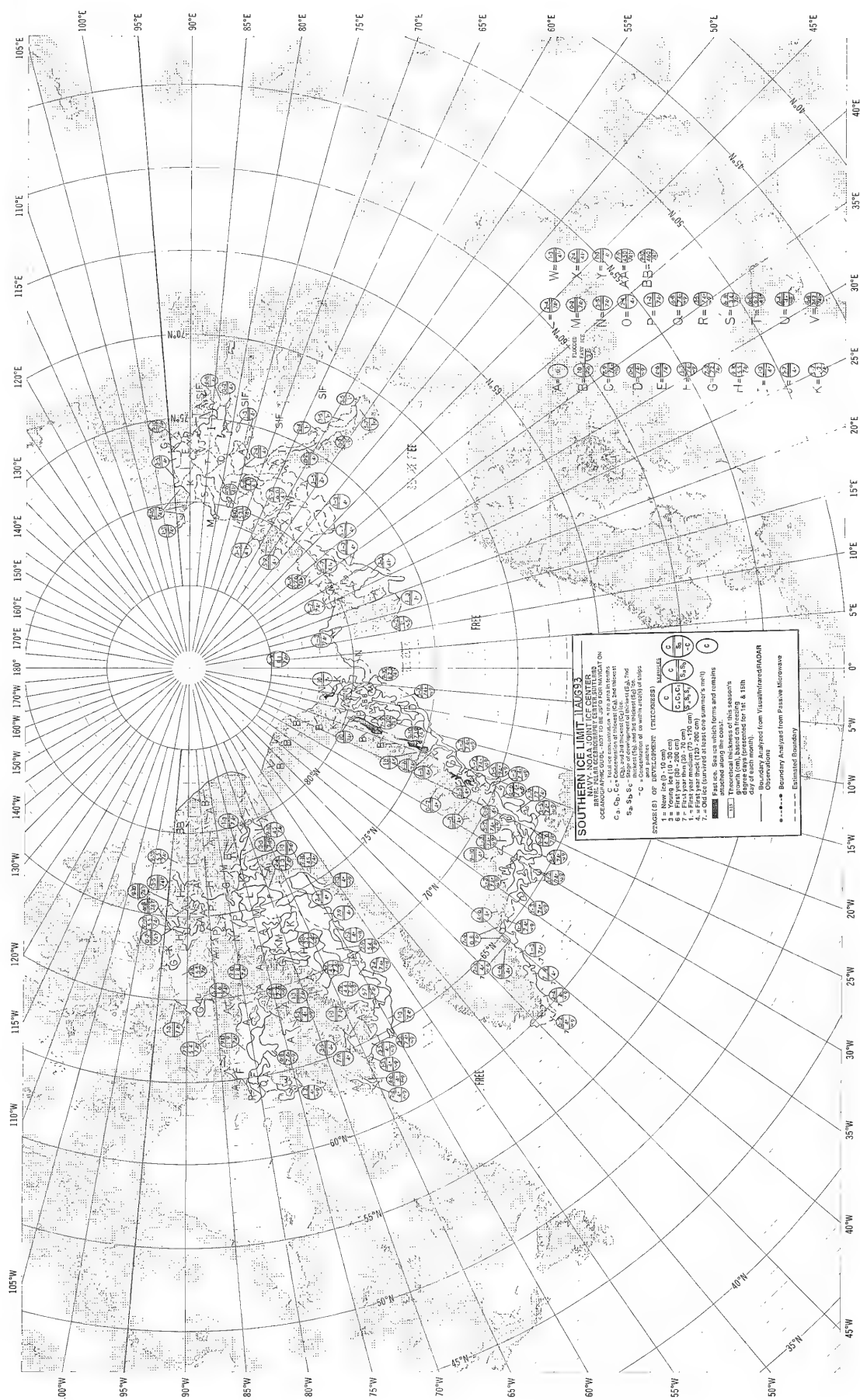


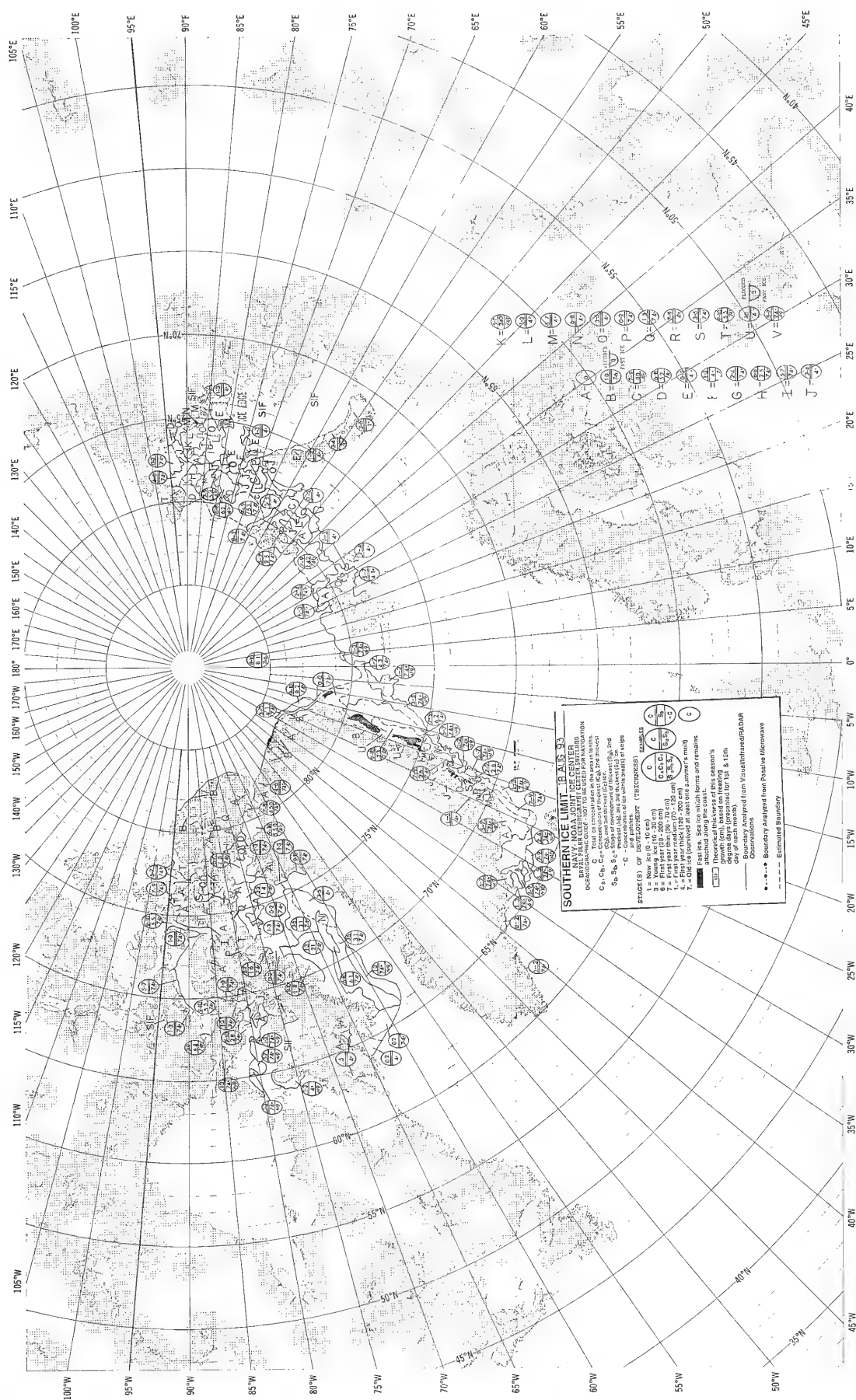


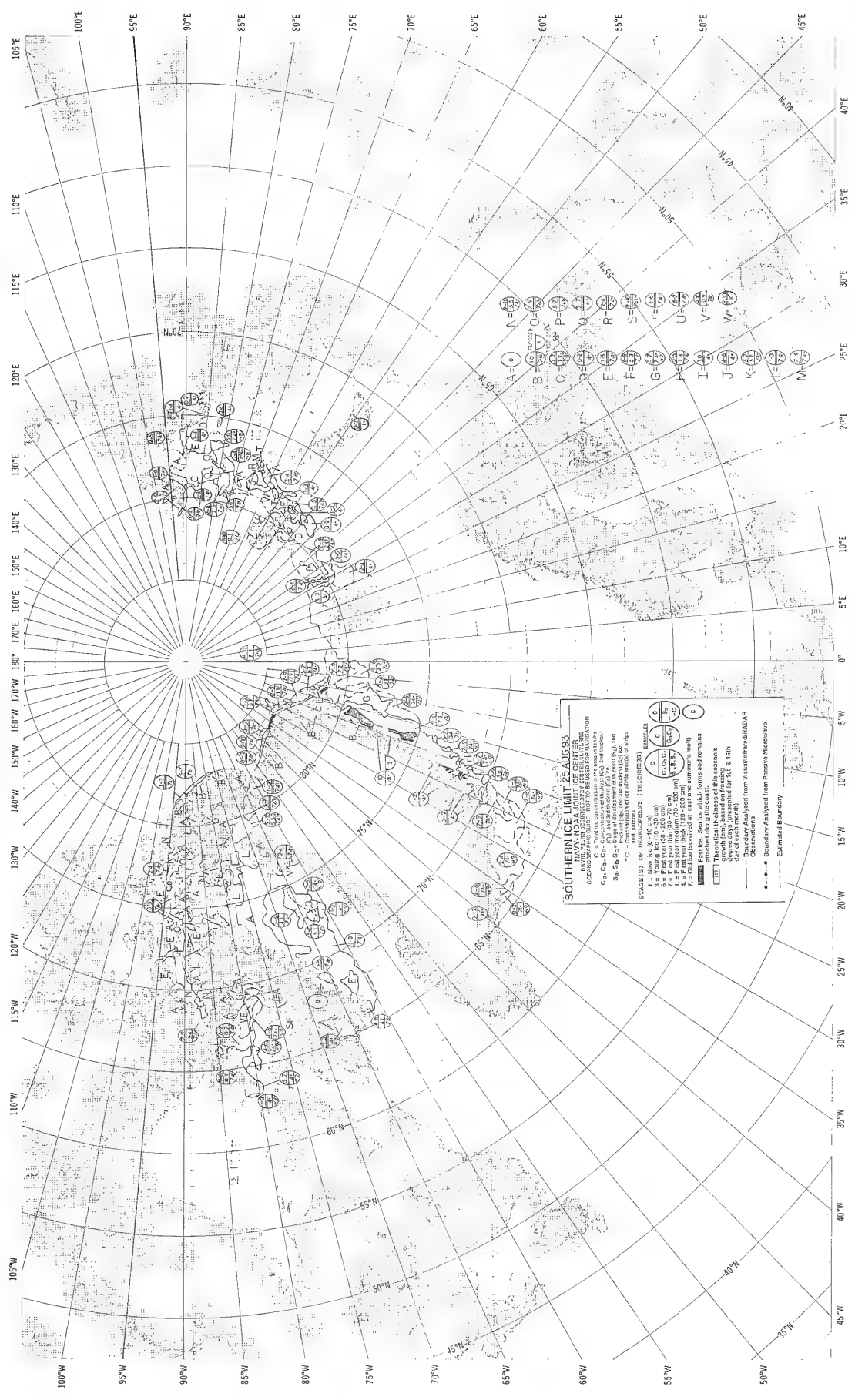












SOUTHERN ICE LIMIT 25 AUG 93
 NAVY, NOAA, JCE CENTER
 BUREAU OF NAUTICS
 OCEANOGRAPHIC CHART, NOT TO BE USED FOR NAVIGATION

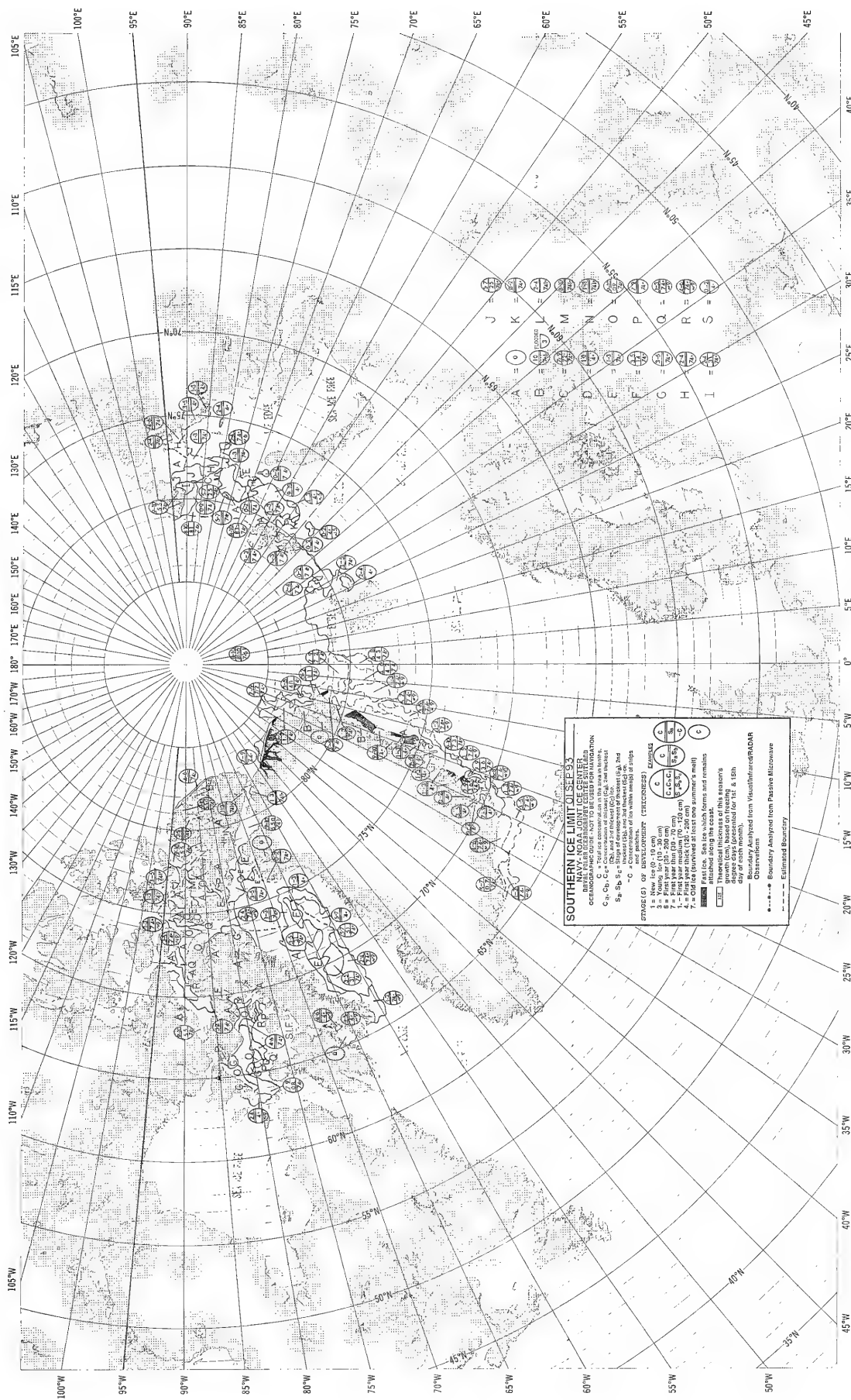
SYMBOLS

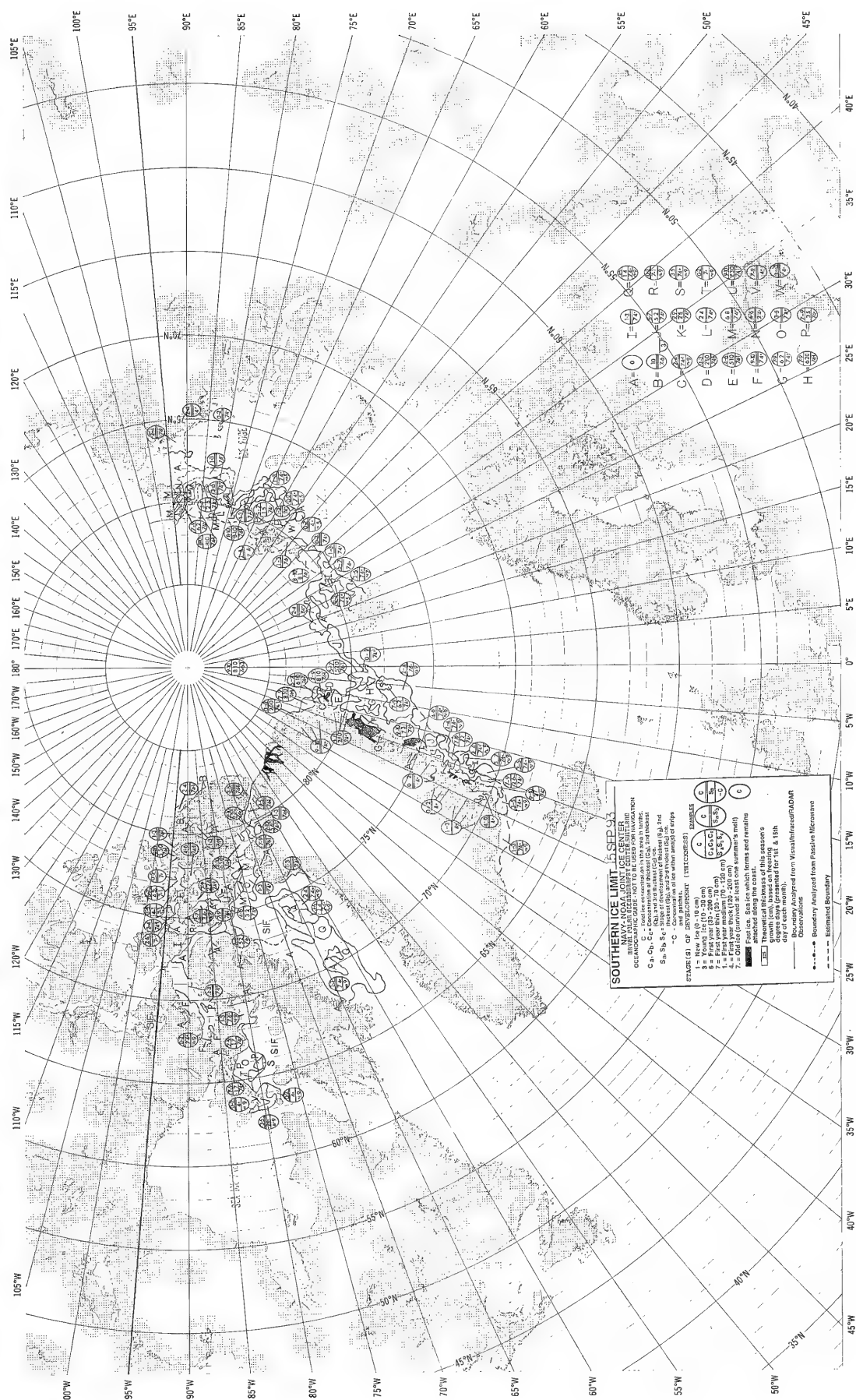
Cp, Ch, Cc - Cumulative of the surface and bottom
 Sd, Sb - Stage of development of bottom (1, 2, 3, 4)
 C - Composite of an entire month of ships

STAGE(S) OF DEVELOPMENT (THICKNESS) SYMBOLS

1 - New ice (0 to 10 cm)
 2 - First year (10 to 20 cm)
 3 - First year (20 to 30 cm)
 4 - First year (30 to 40 cm)
 5 - First year (40 to 50 cm)
 6 - First year (50 to 60 cm)
 7 - Old ice (survived at least one summer's melt)
 8 - Old ice (survived at least two summer's melt)
 9 - Old ice (survived at least three summer's melt)

Other Symbols:
 [Symbol] Fast ice, Sea ice which forms and remains
 [Symbol] Theoretical thickness of this season's
 growth (see text for details)
 [Symbol] Growth (see text for details)
 [Symbol] Day of each month
 [Symbol] Boundary from year from Weather and Radar
 [Symbol] Boundary from Passive Microwave
 [Symbol] Estimated Boundary



15 SEP 93
COUTHERN ICE LIMIT

SOUTHERN ICE CENTER
NAVY-NOAA JOINT ICE CENTER

NAVAL POLAR OCCUPANCY TEST REPORT
OCEANOGRAPHIC GUIDE - NOT TO BE USED FOR NAVIGATION

C_a, C_b, C_c = Concentration of thickest (Ca), 2nd thickest (Cb), and 3rd thickest (Cc) concentration in the area in tonnes.

S_A, S_B, S_C = Stage of development of thicket (Fig. 2d)

-C = Concentration of ice within area(s) of strips

STAGE(S) OF DEVELOPMENT (THICKNESS)
and pattern.

1 = New Ice (0 - 10 cm)
2 = Young Ice (10 - 30 cm)

6 = First year (30–200 cm)

1. = First year medium (70 - 120 cm)

4. = First year chick (120 - 200 cm)
7. = Old ice (survived at least one summer's melt)

Fast ice. Sea ice which forms and remains attached along the coast.

125 Theoretical thickness of this season's

growth (cm), based on freezing degree days (presented for 1st & 15th

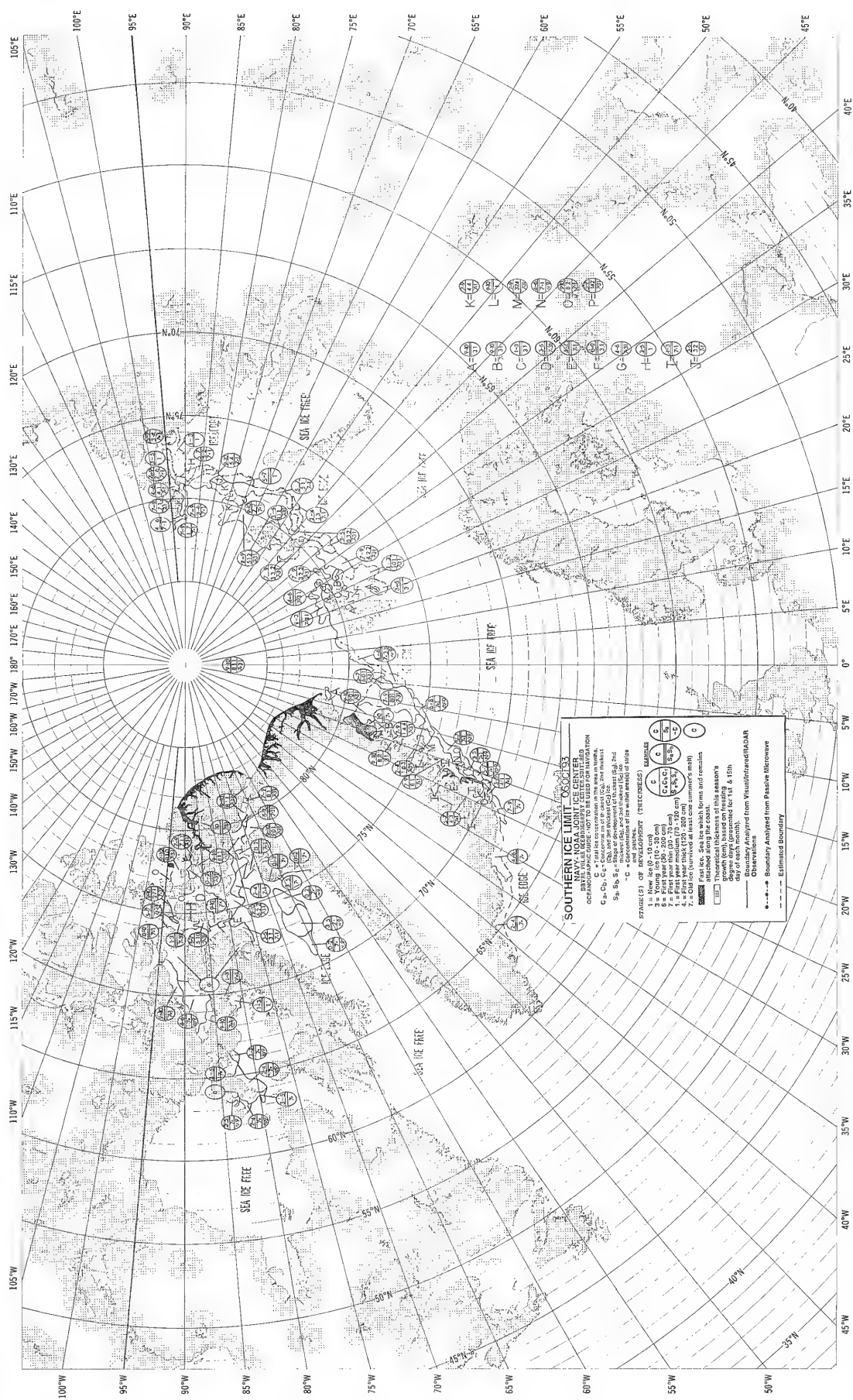
day of each month).

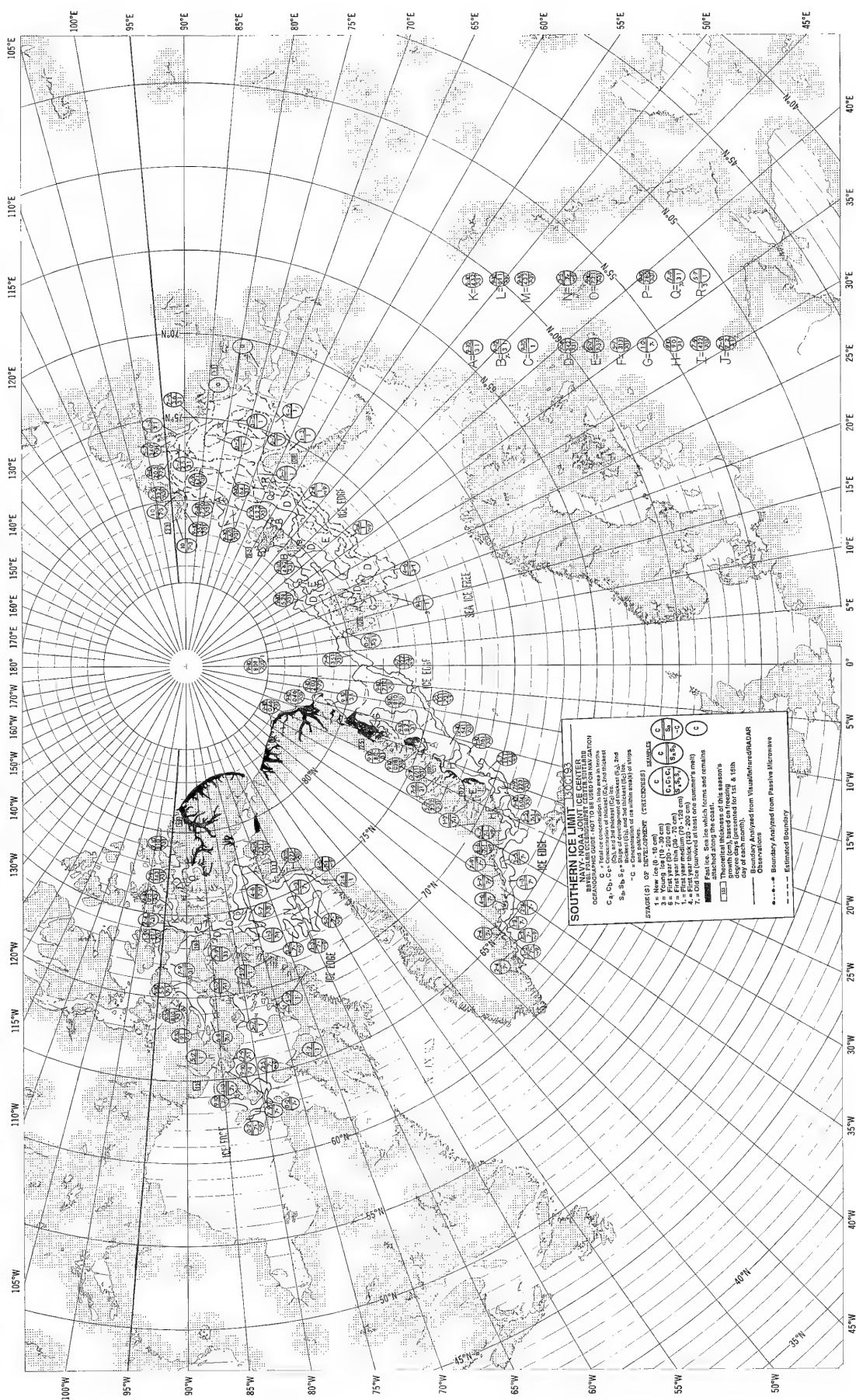
Boundary Analyzed from	Observations
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100	100

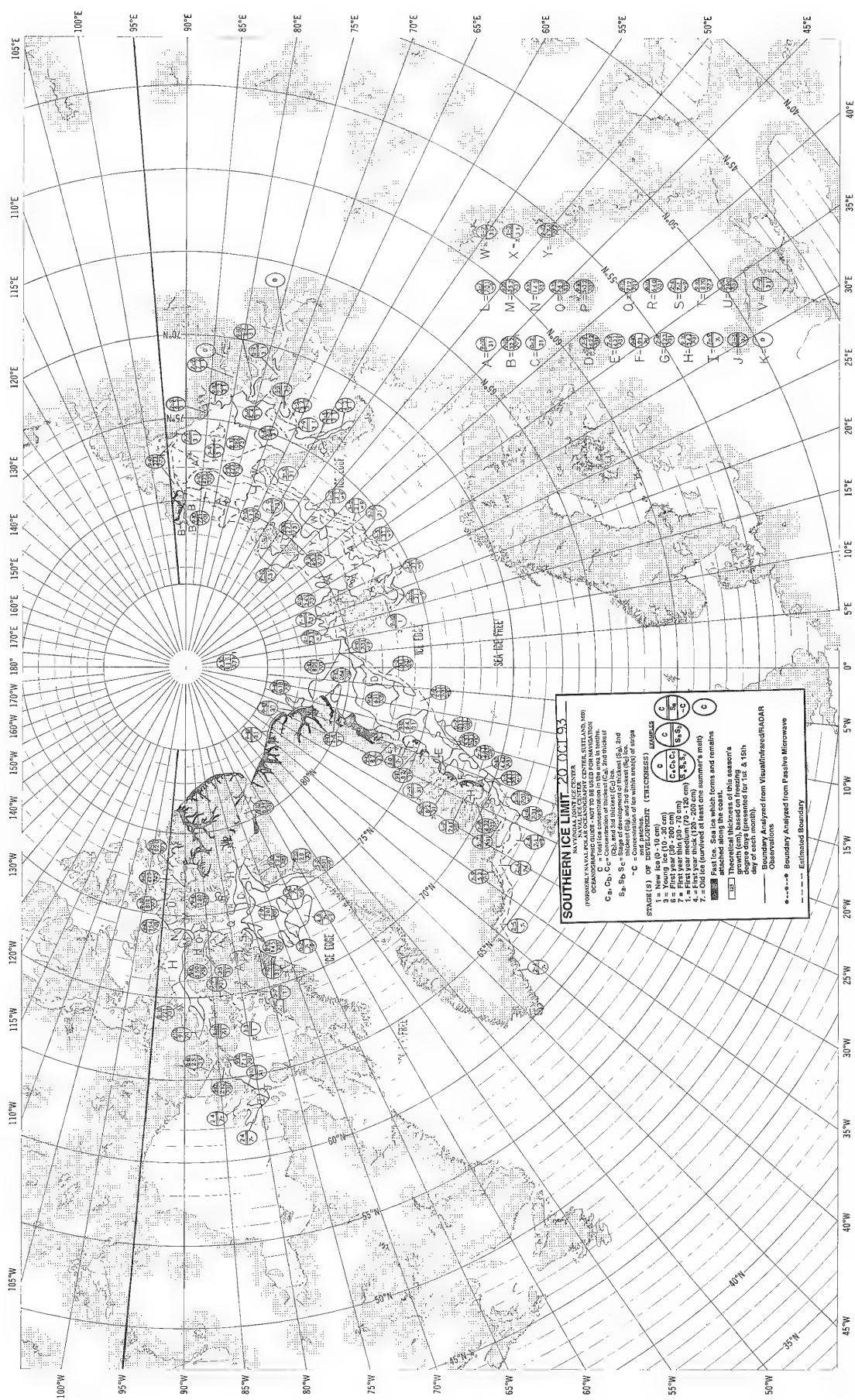
●●●●● Boundary Analyzed from Passive Microwave

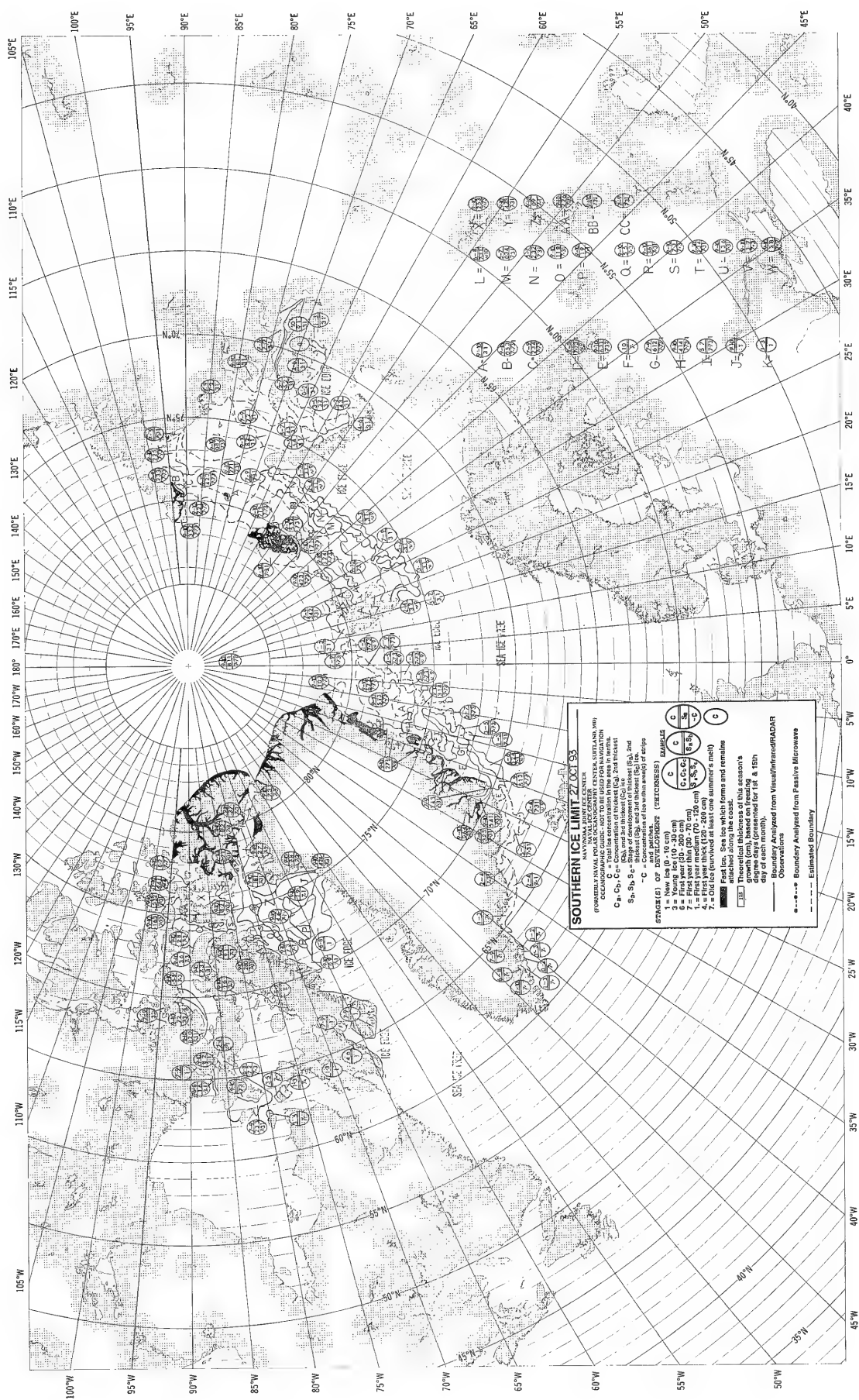
--- Estimated Boundary

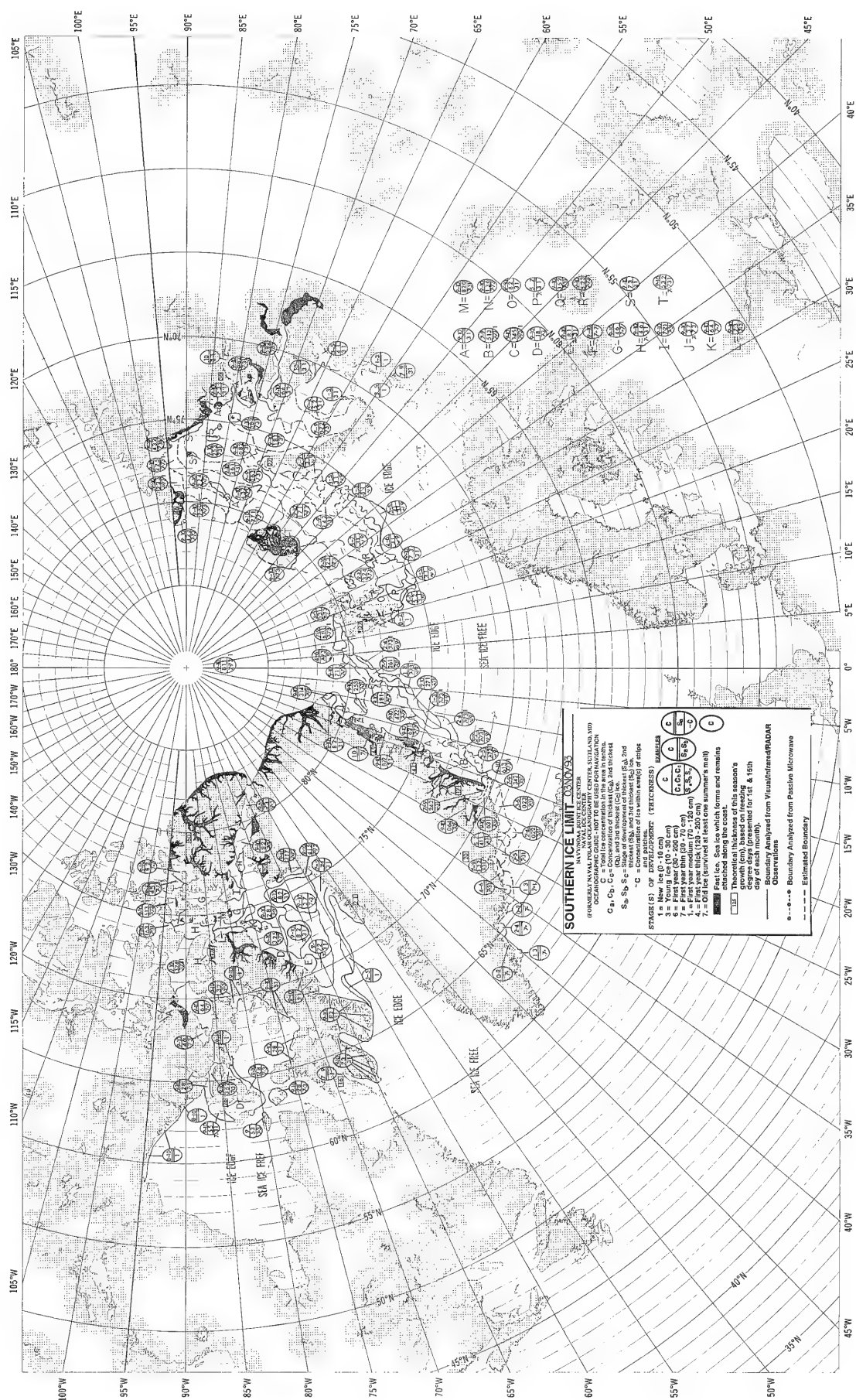
M₀51 15°W M₀02 20°W M₀52 25°W

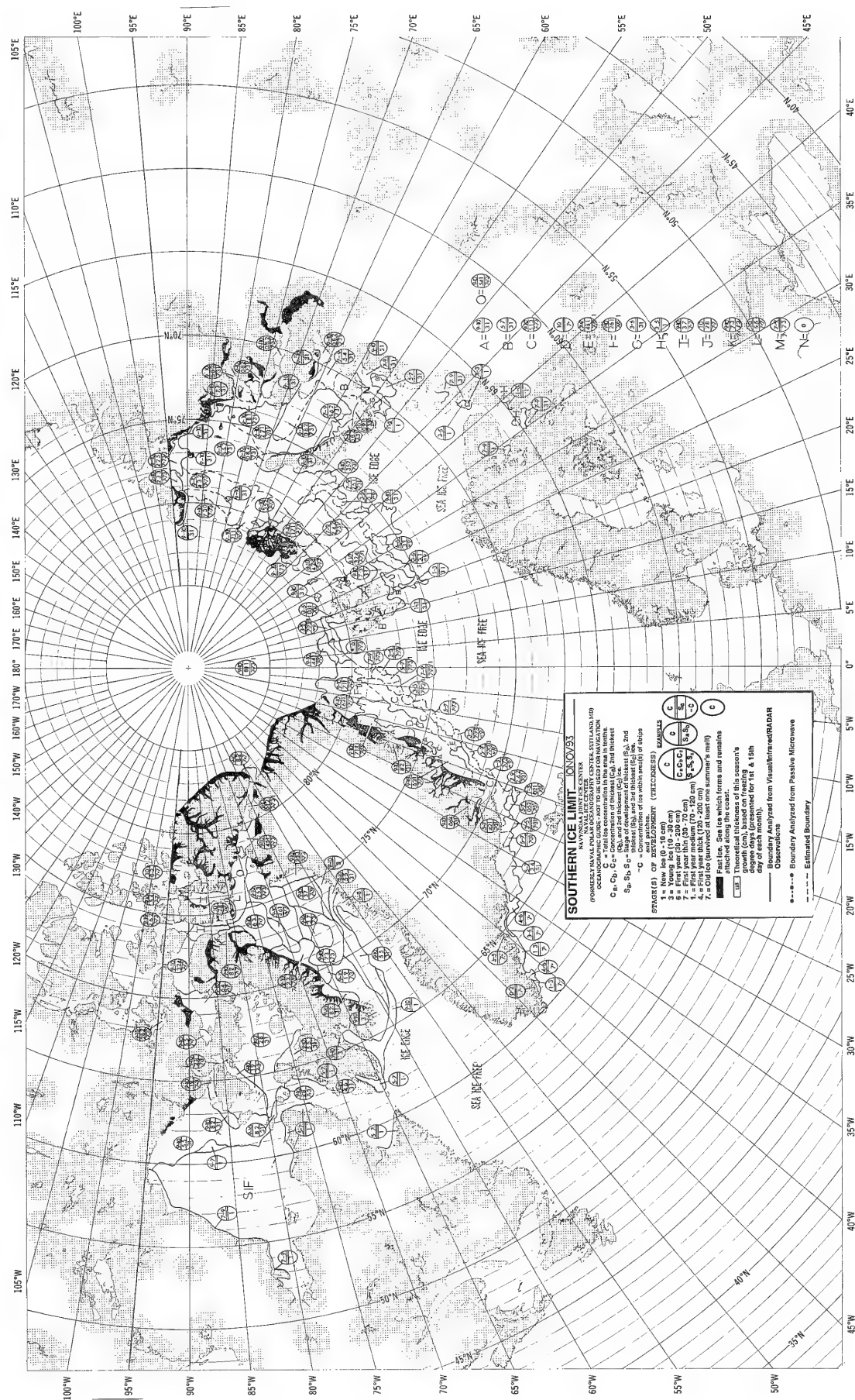


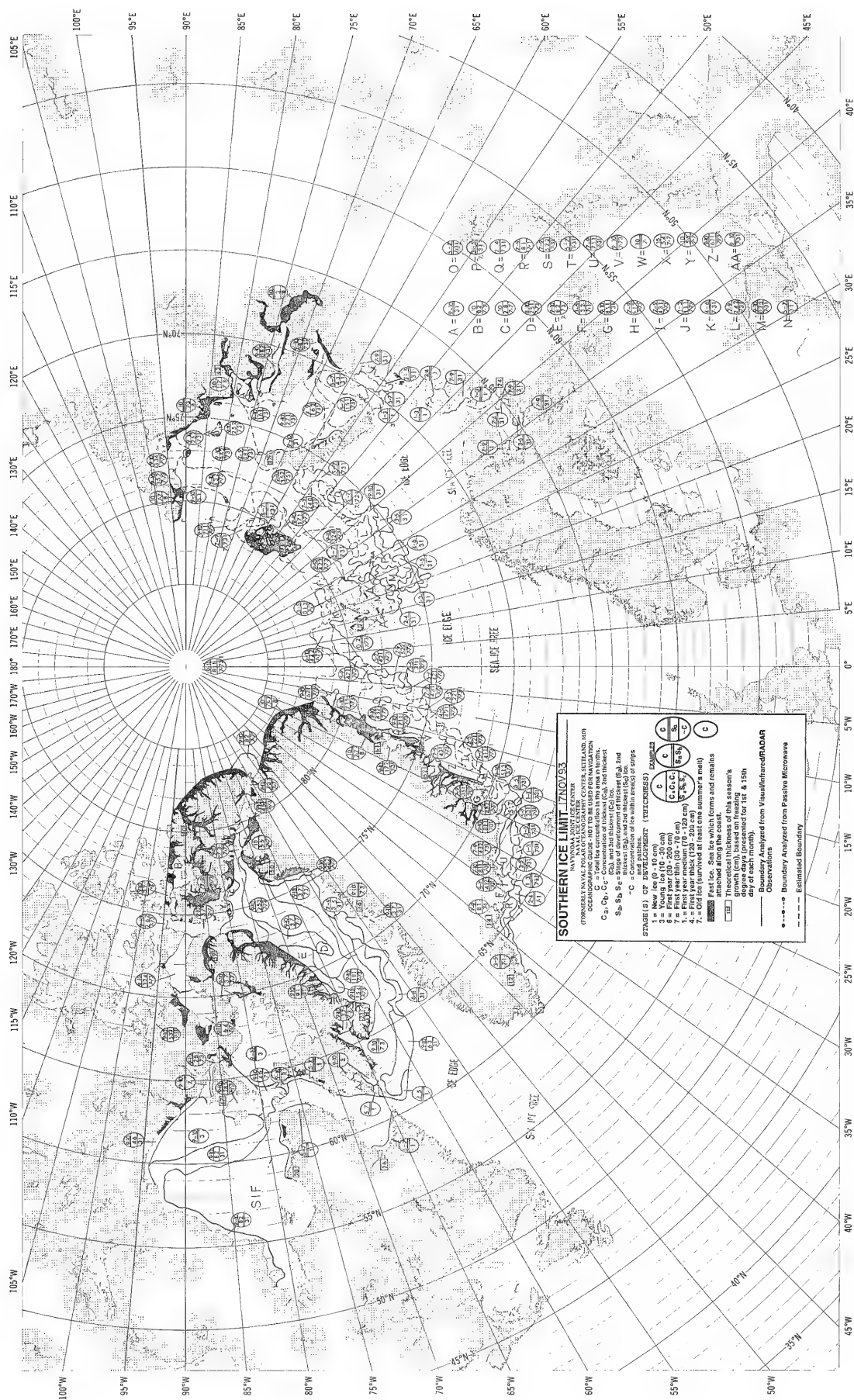


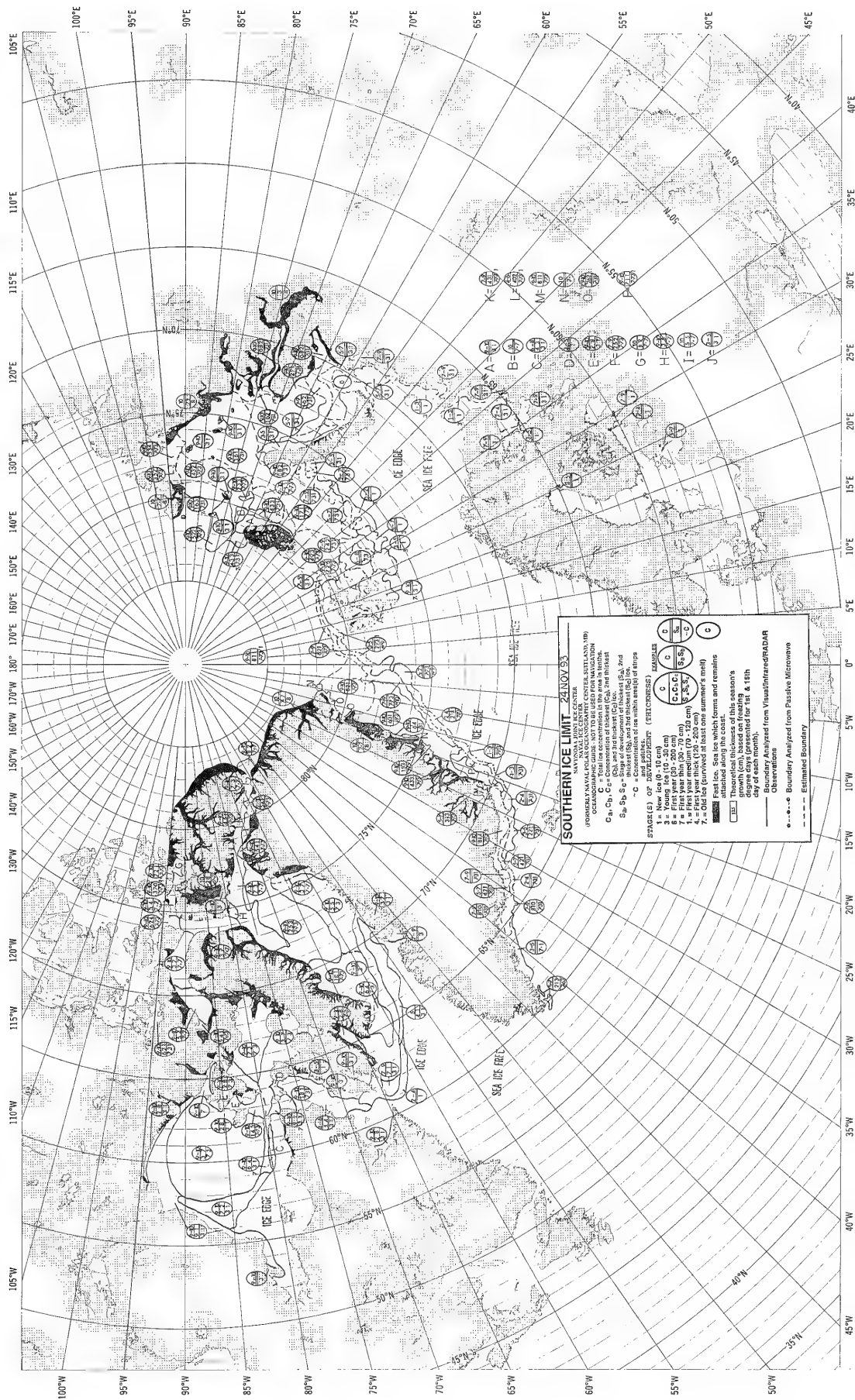


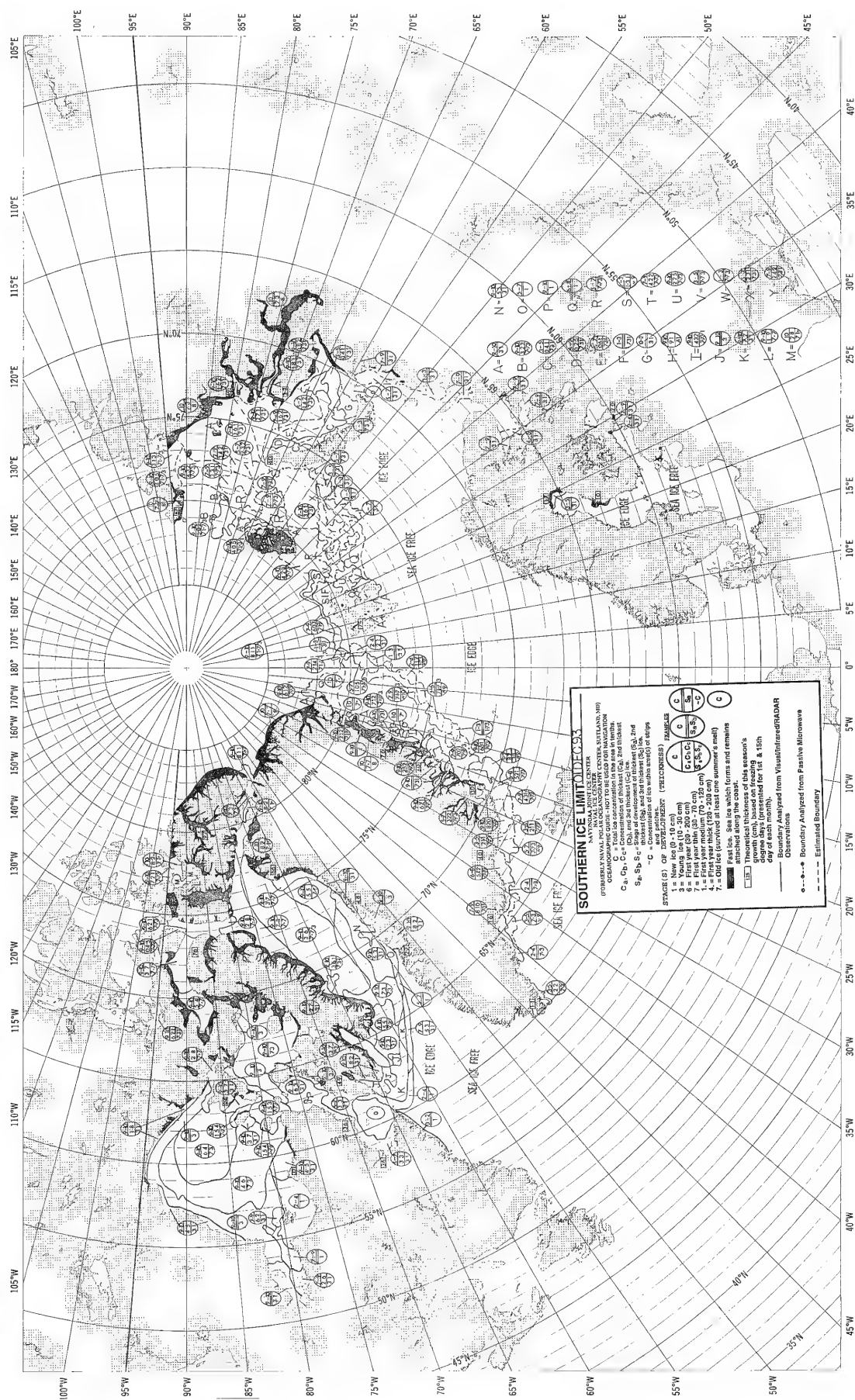


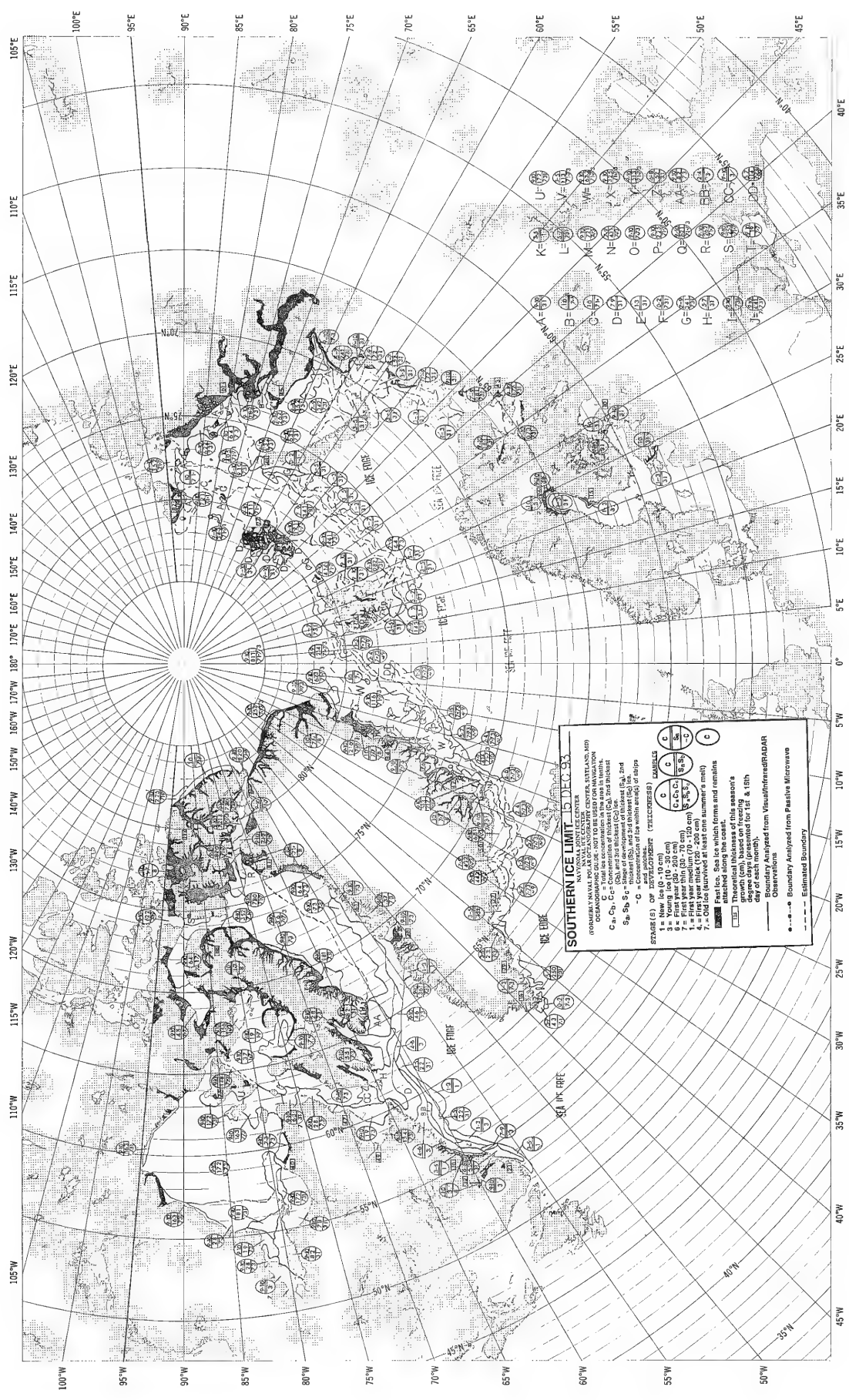












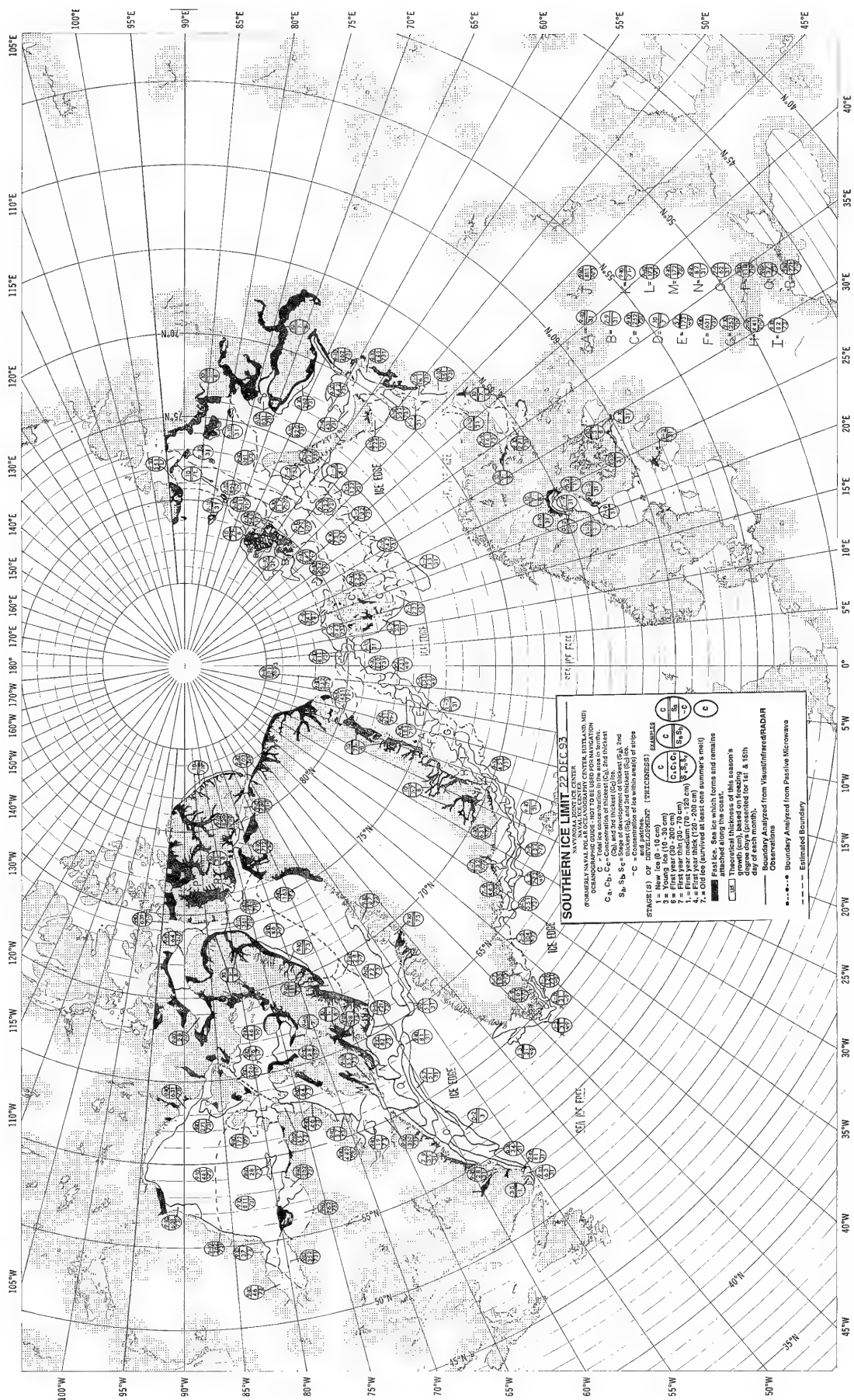
SOUTHERN ICE LIMIT 15 DEC 93

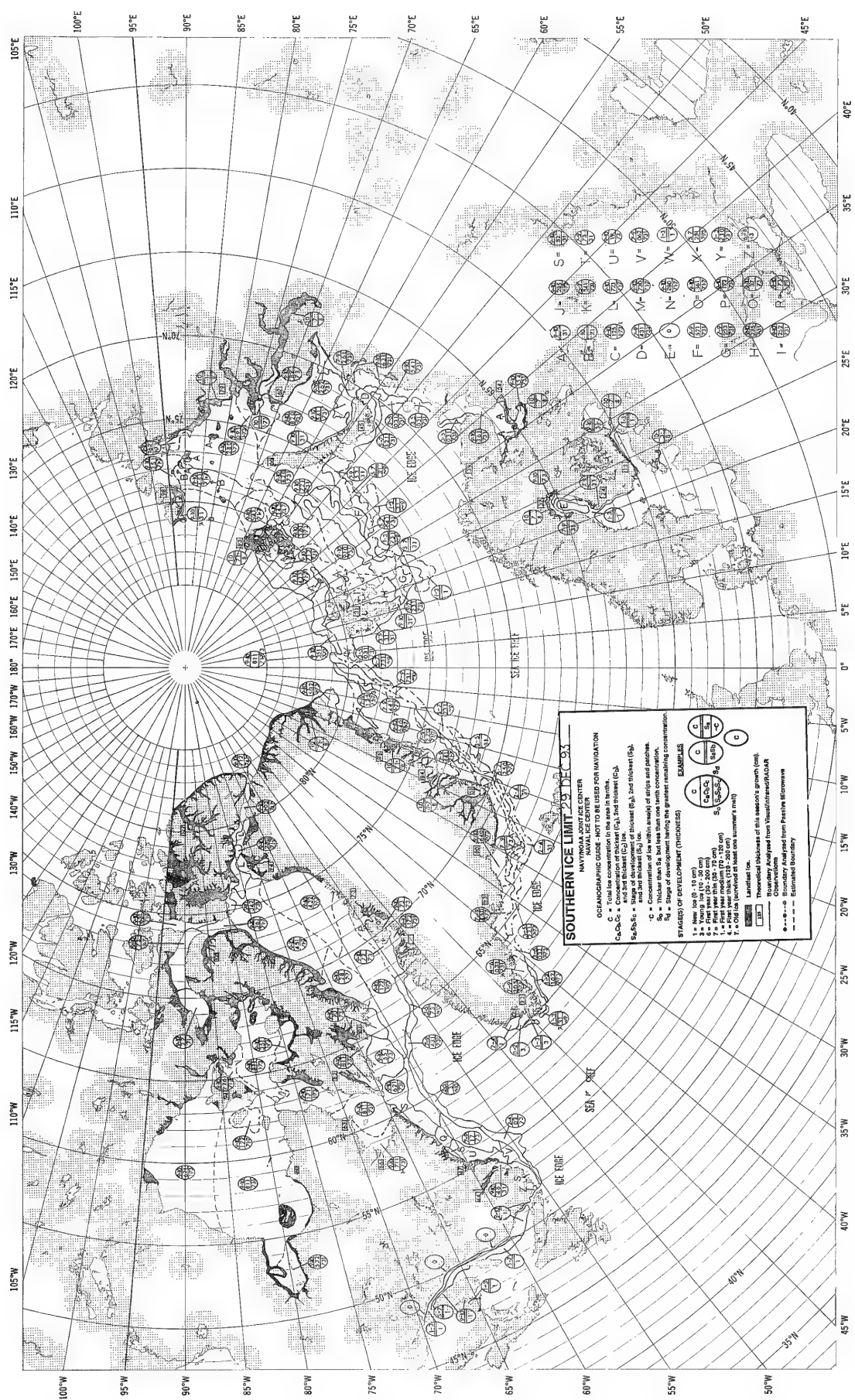
NATIONAL DATA CENTER
 (FORMERLY NAVAL POLAR OPERATIONS AND NAVIGATION CENTER)
 C = Total ice concentration in the area in tenths
 C₁, C₂, C₃ = C₁ (th), and C₂ (th) and C₃ (th)
 S₁, S₂, S₃ = S₁ (m), S₂ (m), and S₃ (m) (m) and S₃ (m)
 C = Concentration of ice within area of ships

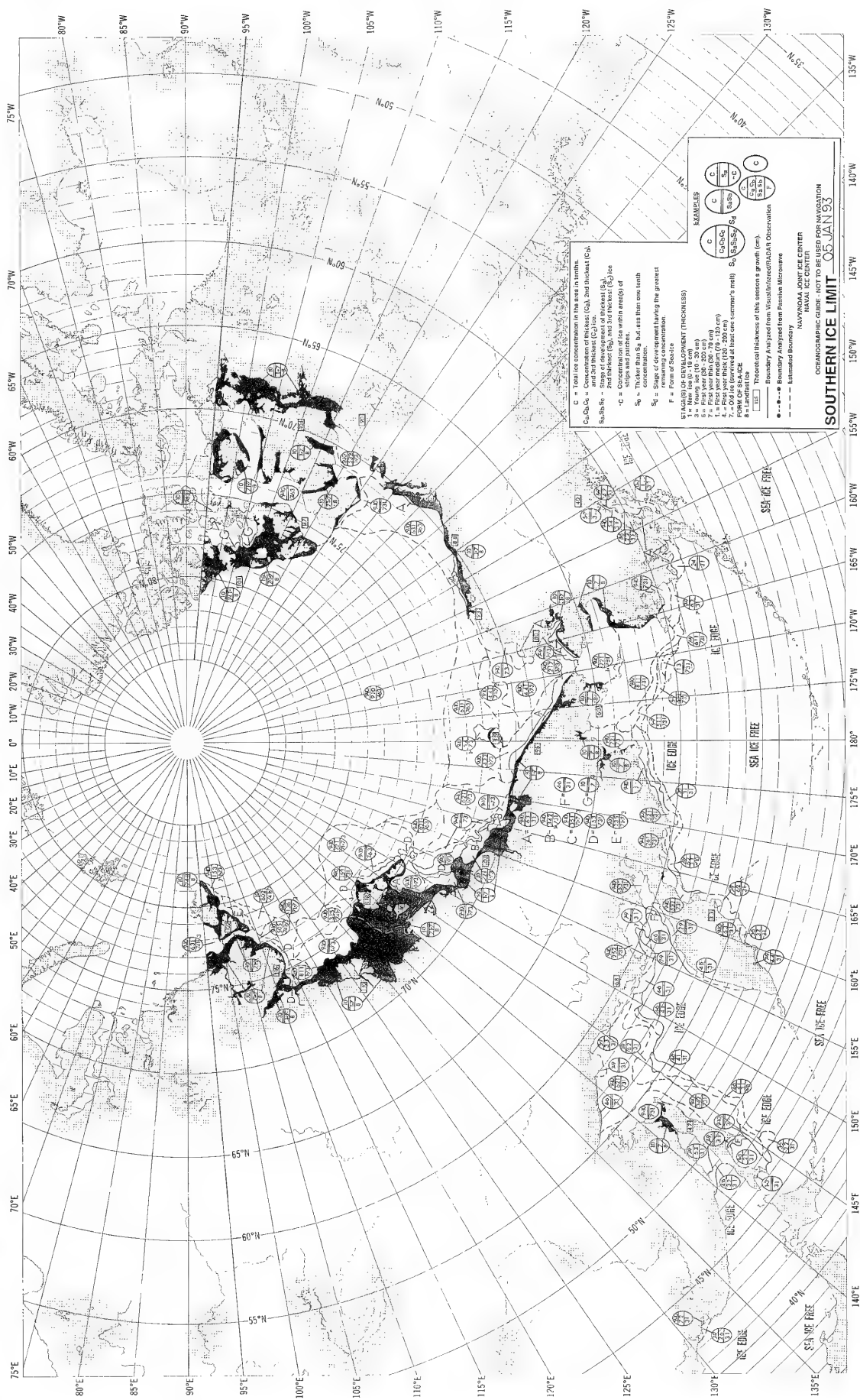
STAGES OF DEVELOPMENT (TELESCOPES) CAMELS

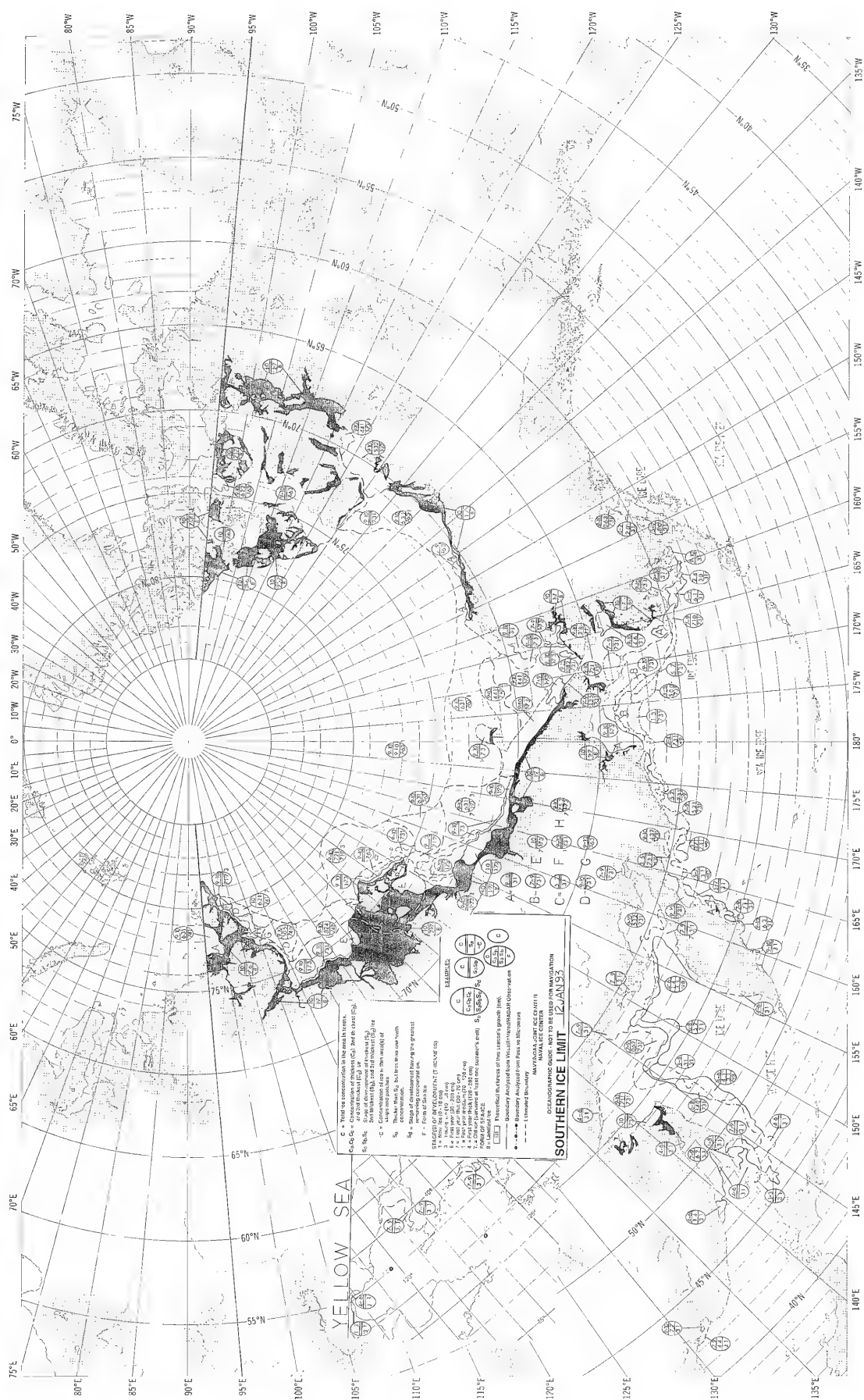
1 = New ice (10 - 30 cm)
 2 = First year (30 - 200 cm)
 3 = First year (200 - 100 cm)
 4 = First year (100 - 10 cm)
 5 = First year (10 - 1 cm)
 6 = First year (1 - 1 cm)
 7 = First year (1 - 1 cm)
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 94 = First year (1 - 1 cm)
 95 = First year (1 - 1 cm)
 96 = First year (1 - 1 cm)
 97 = First year (1 - 1 cm)
 98 = First year (1 - 1 cm)
 99 = First year (1 - 1 cm)
 100 = First year (1 - 1 cm)

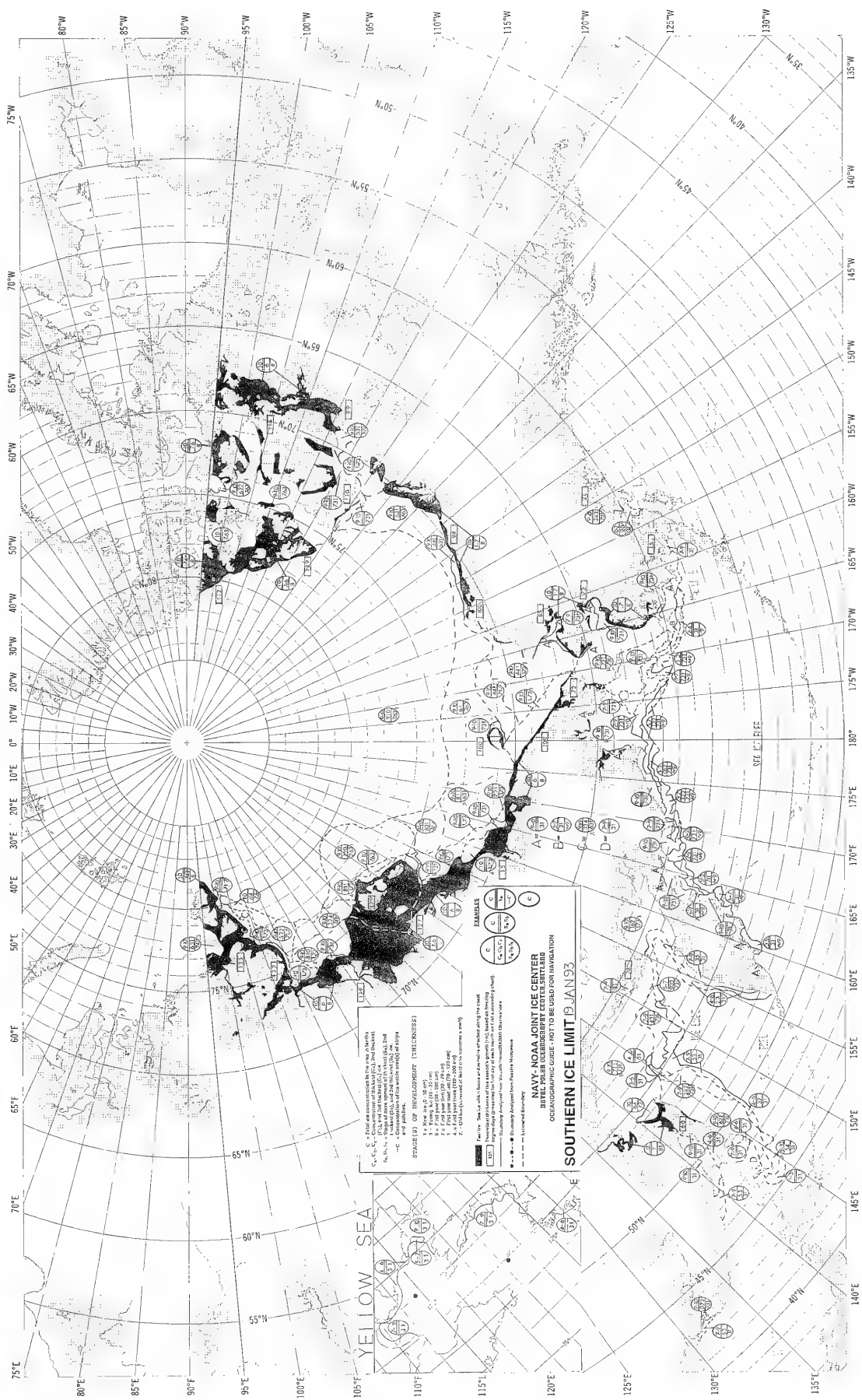
Legend:
 - - - - - Boundary Analyzed from Passive Microwave
 - - - - - Boundary Analyzed from Visual/Infrared/RADAR
 - - - - - Estimated Boundary

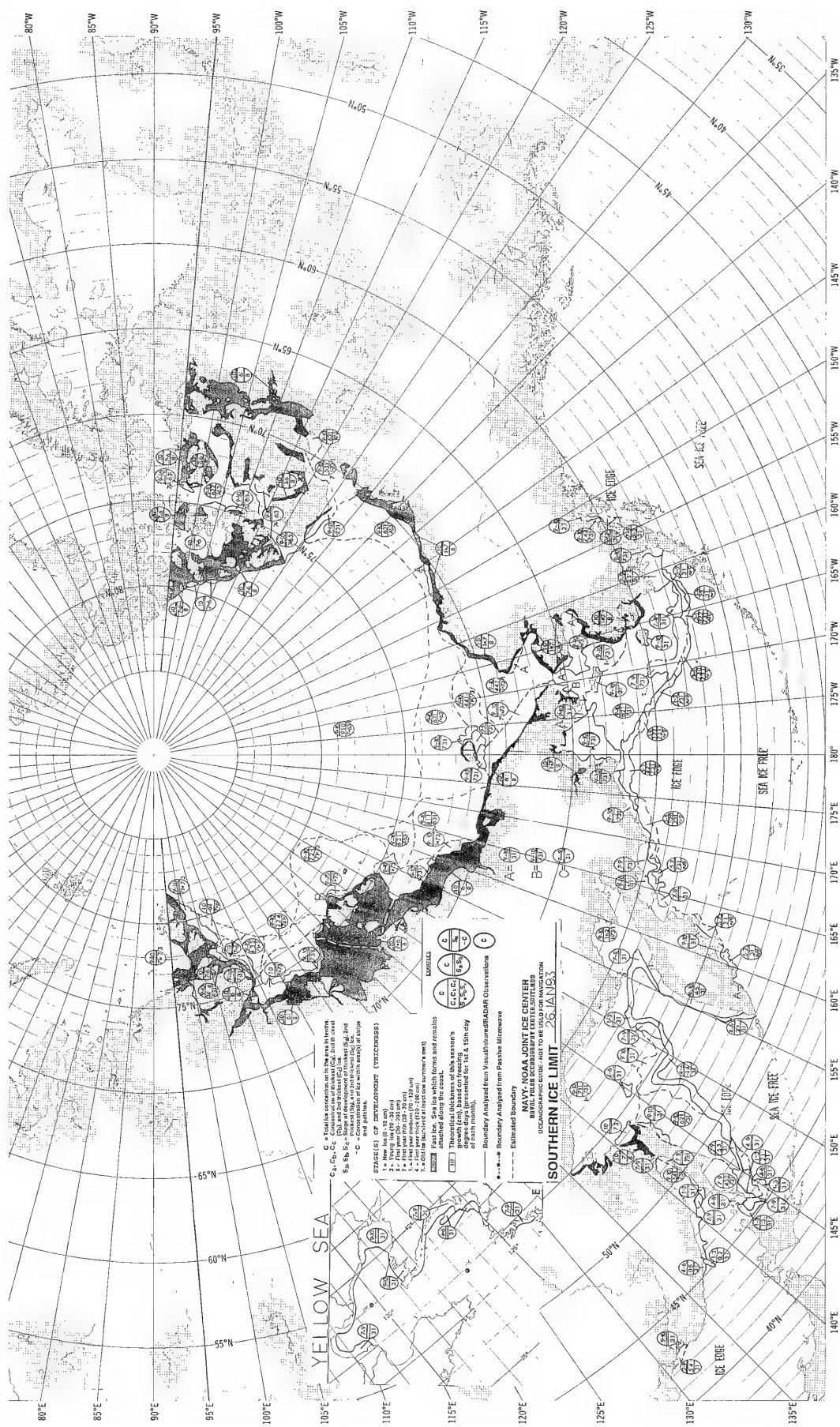


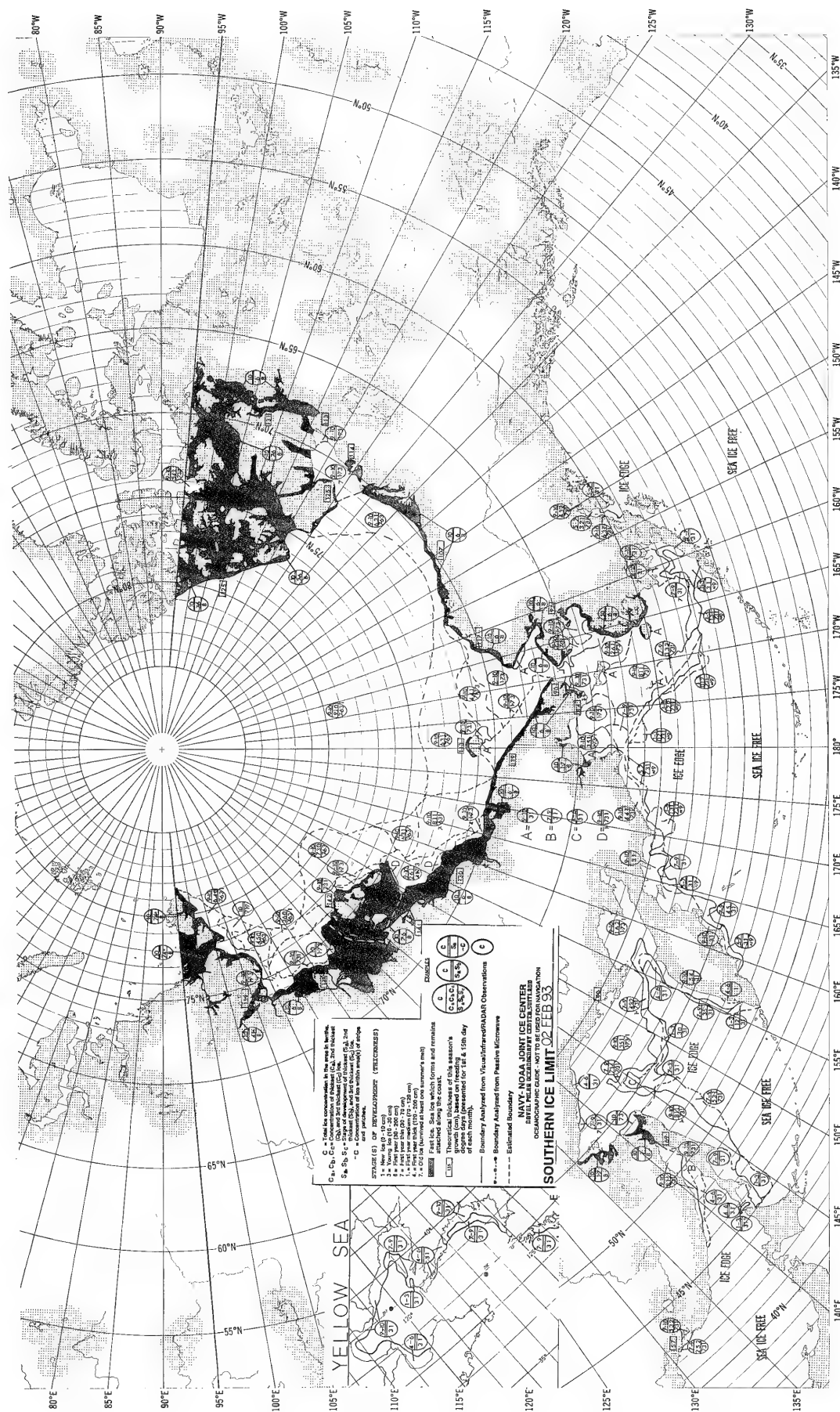


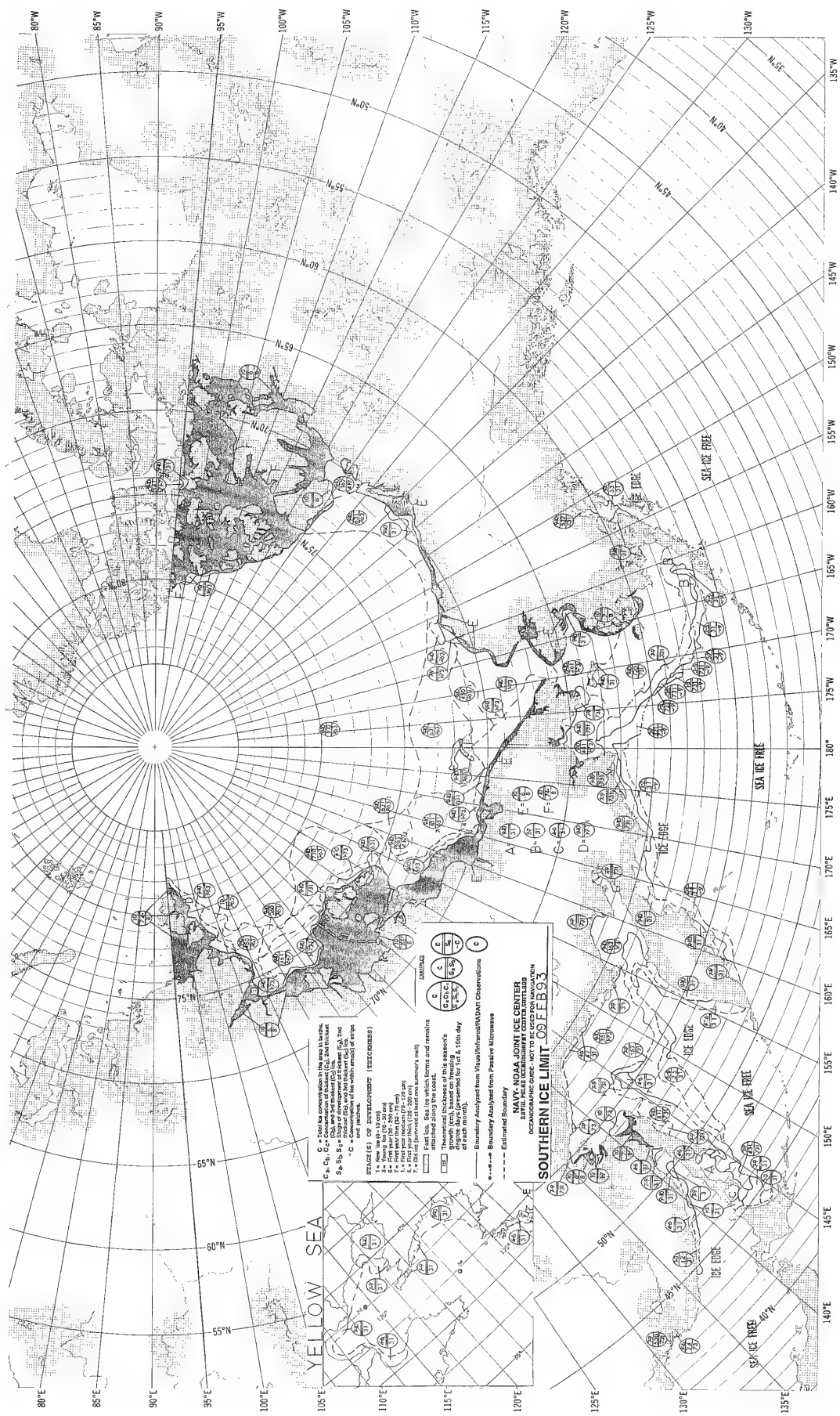


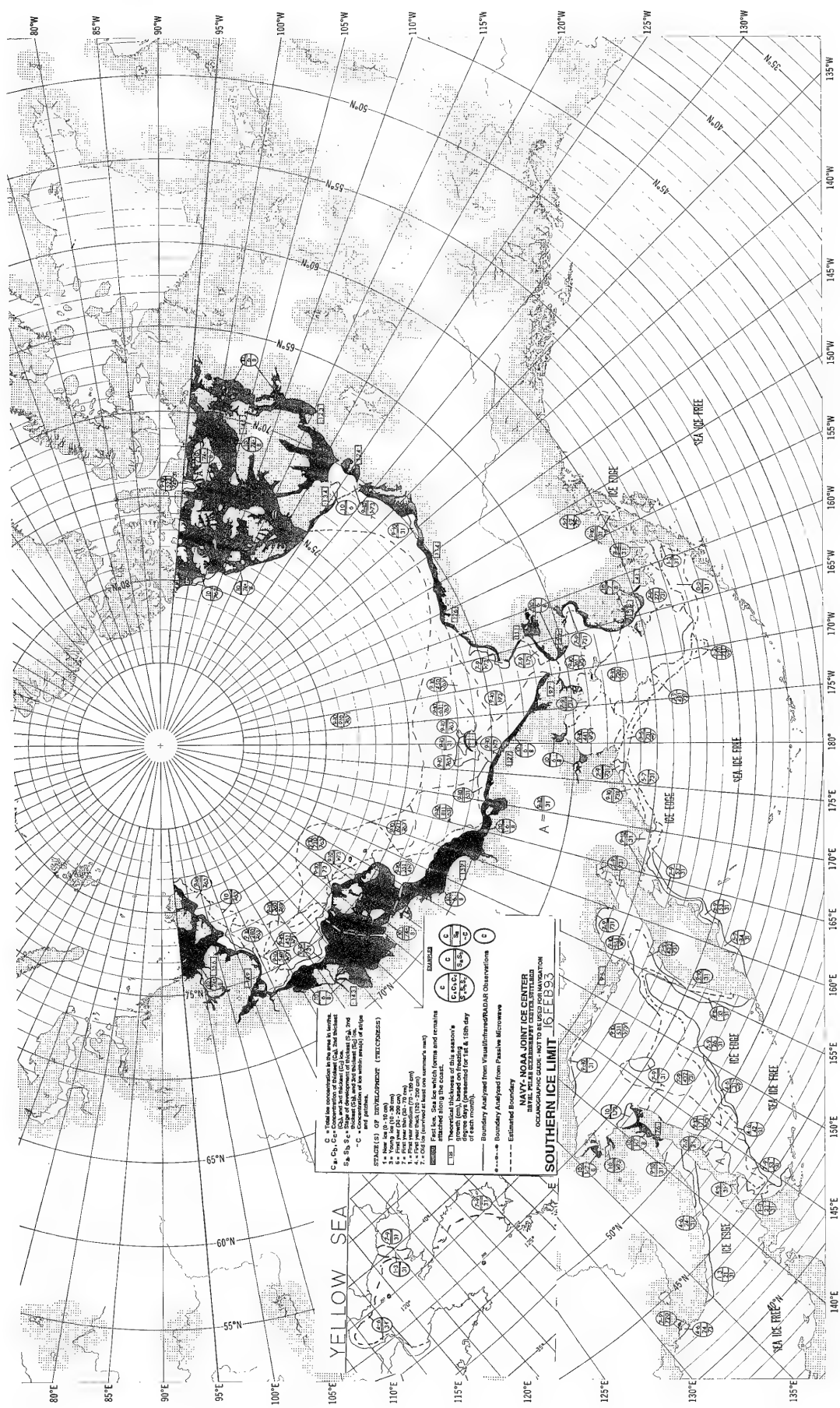


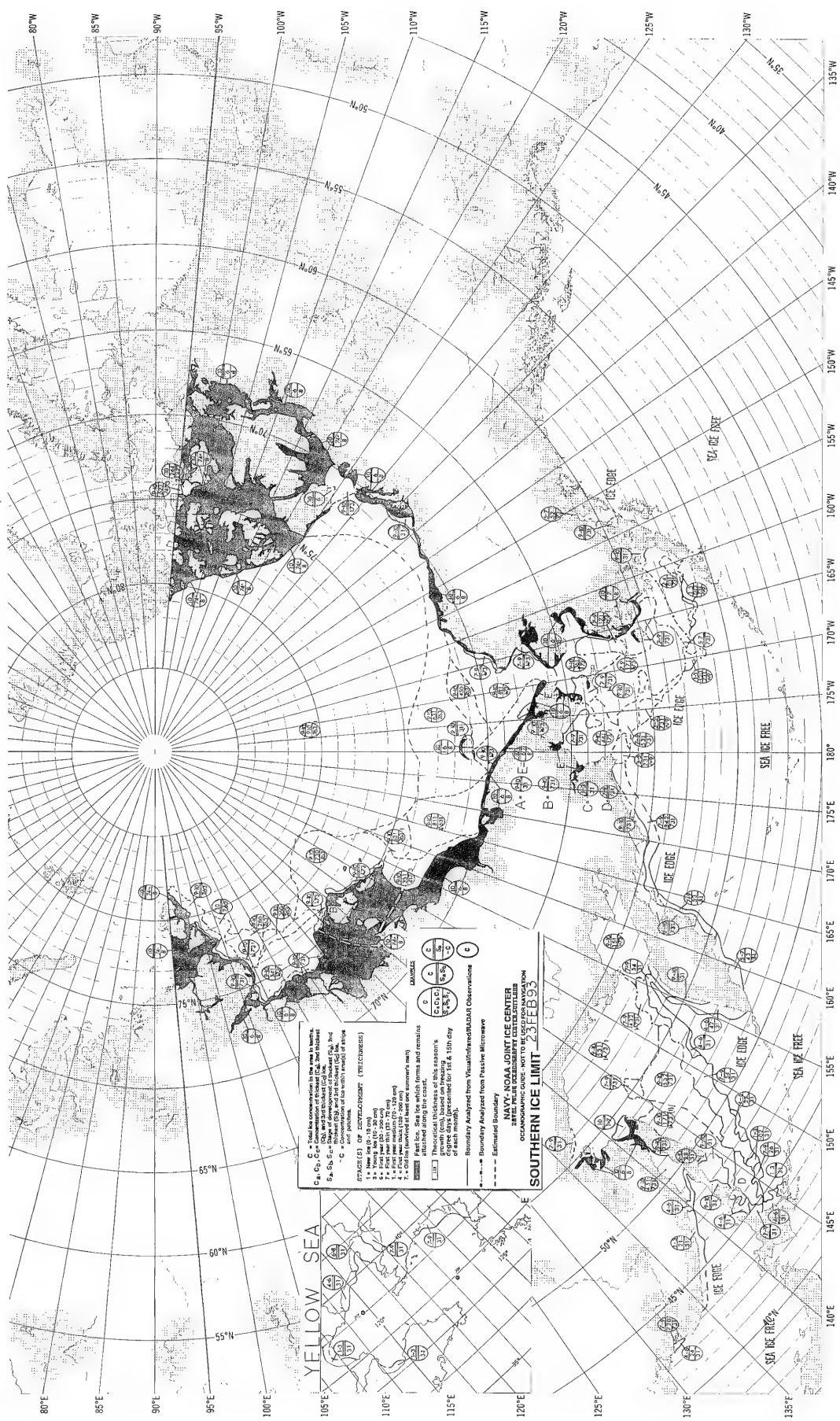


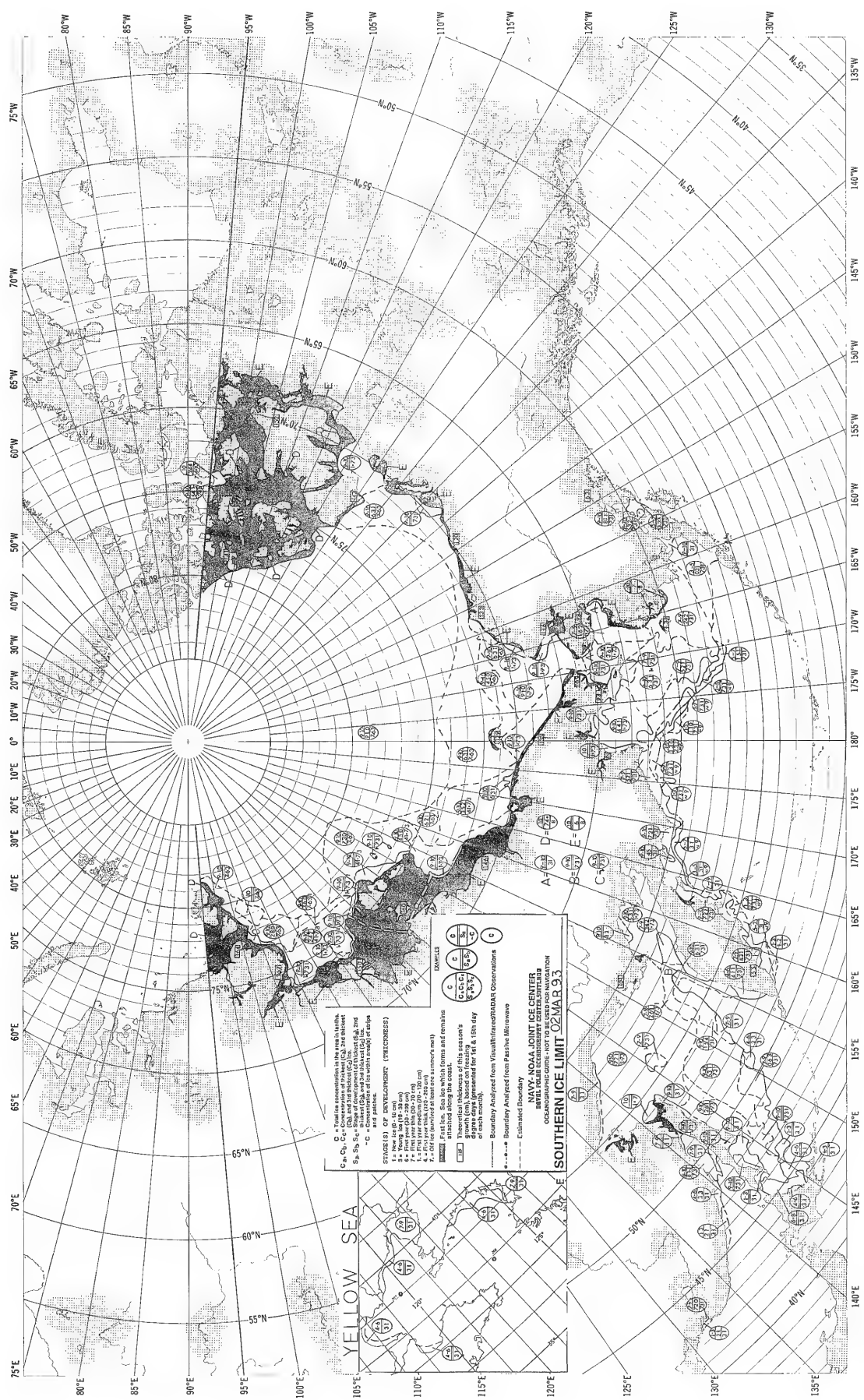


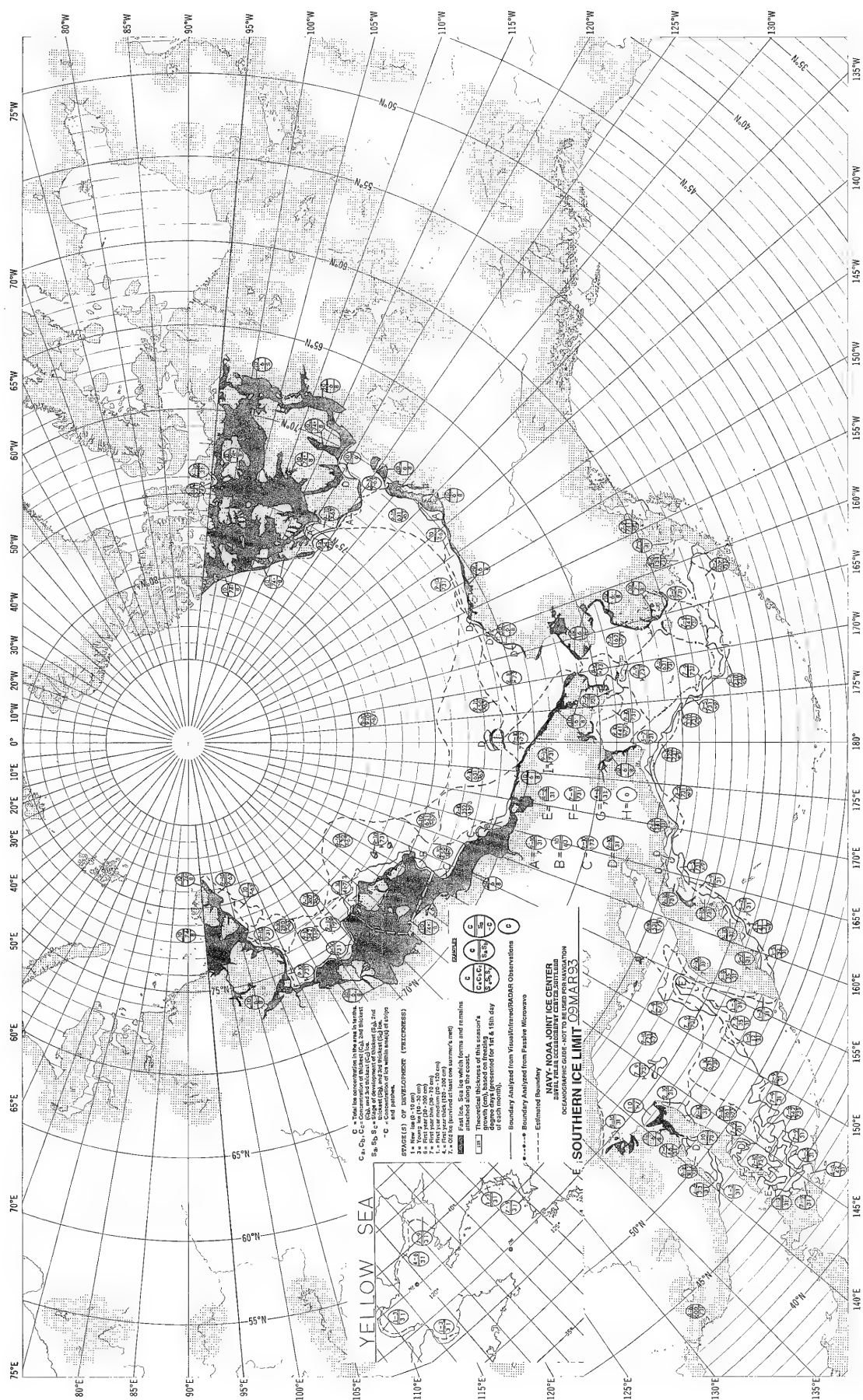


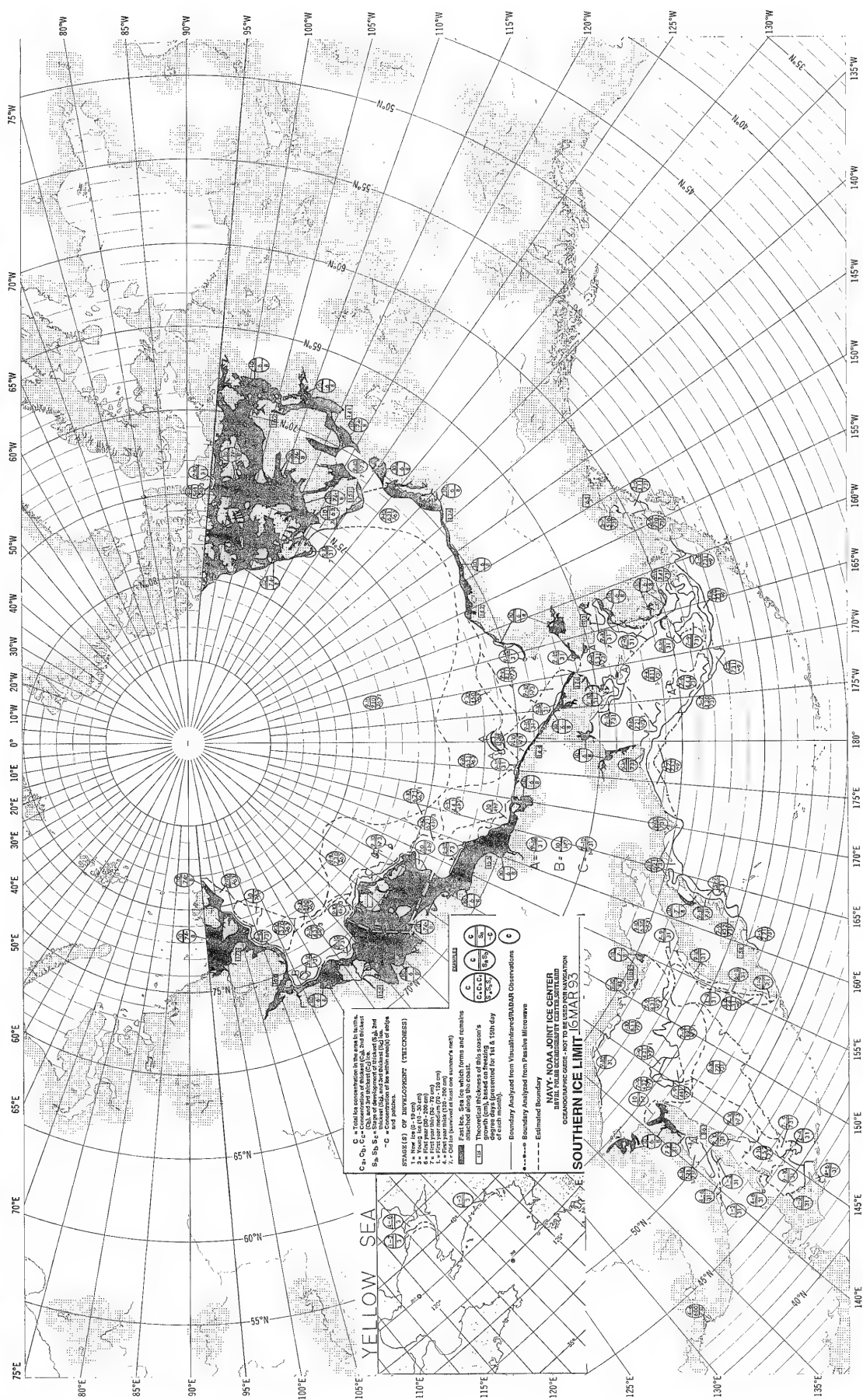


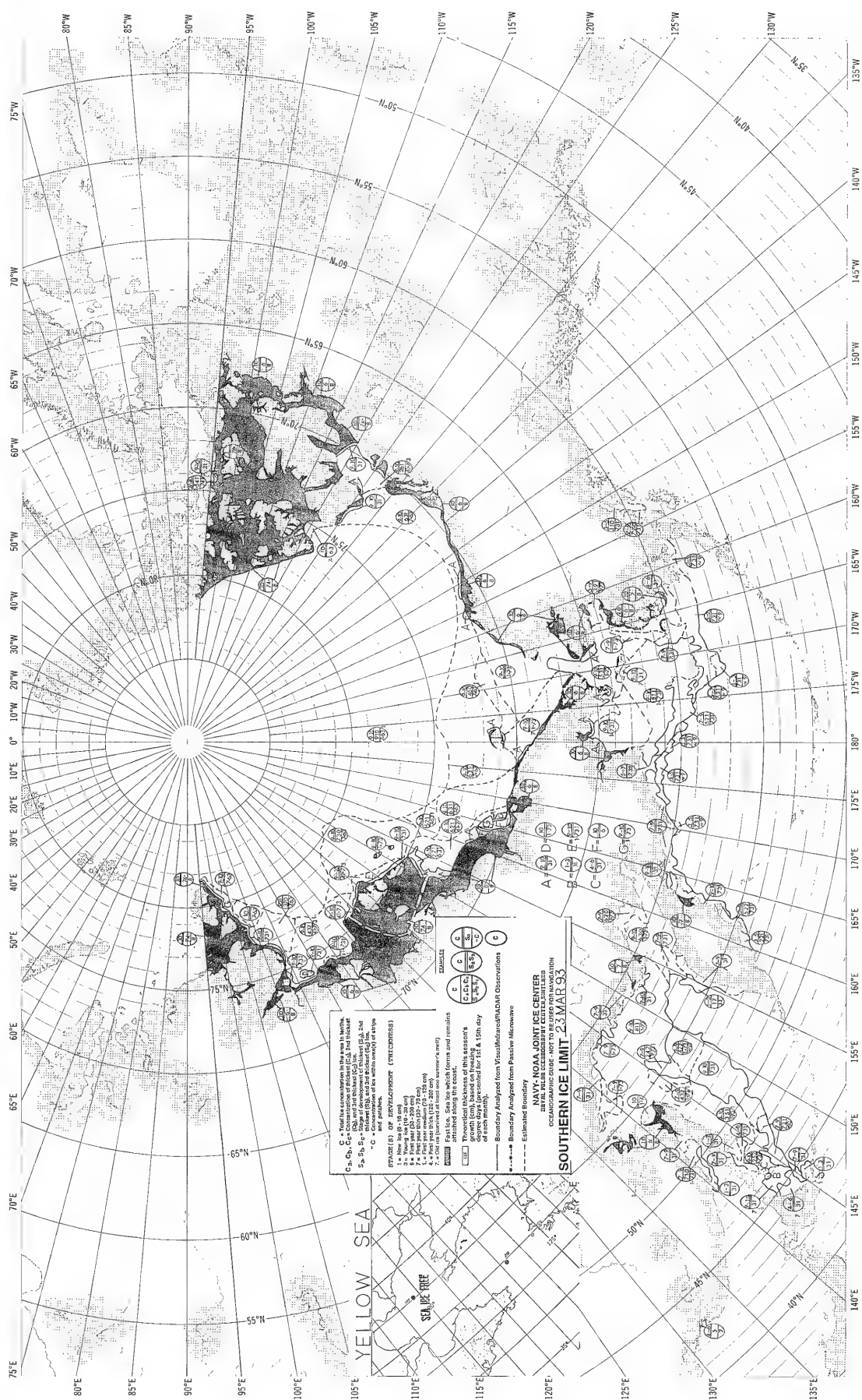


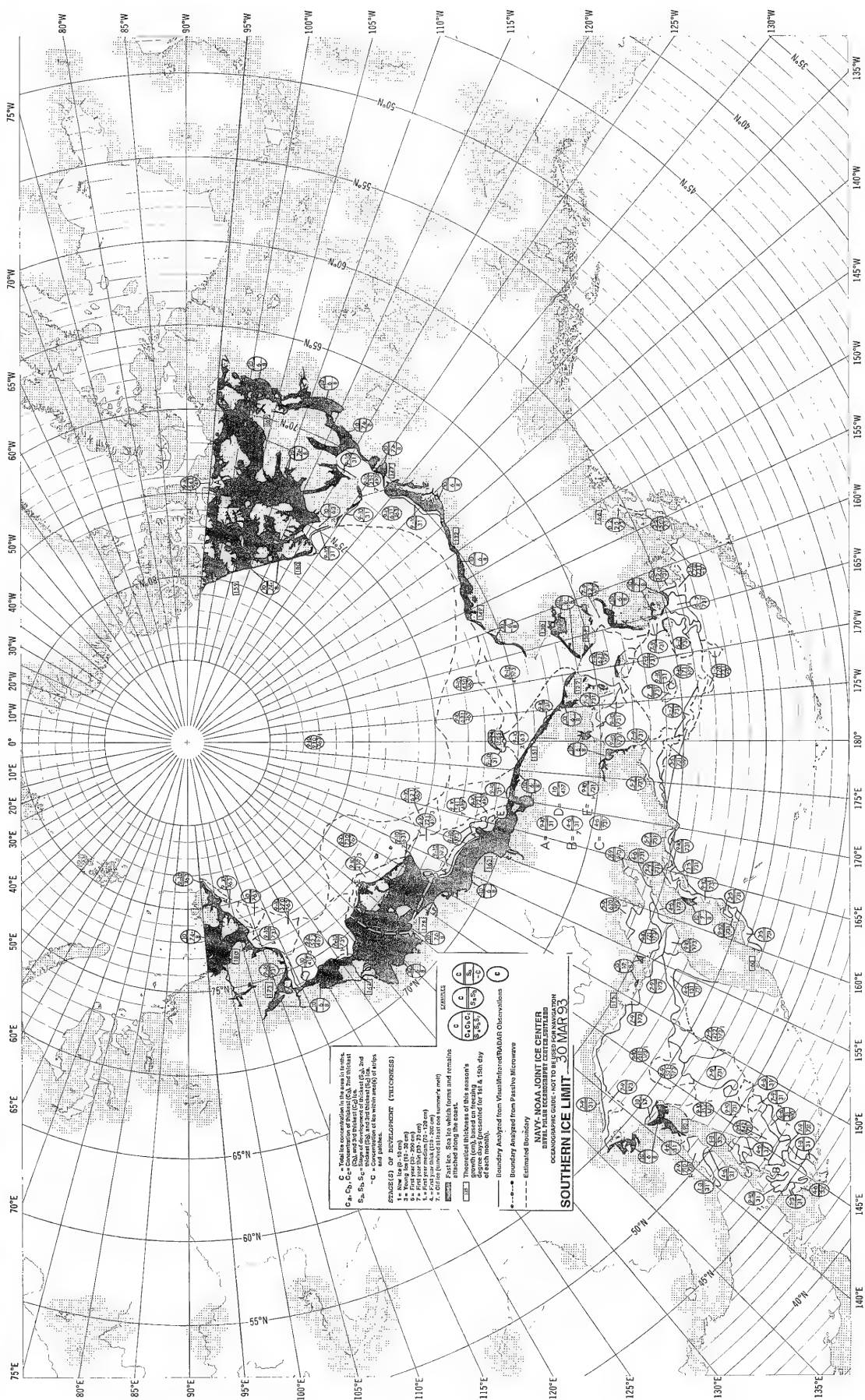


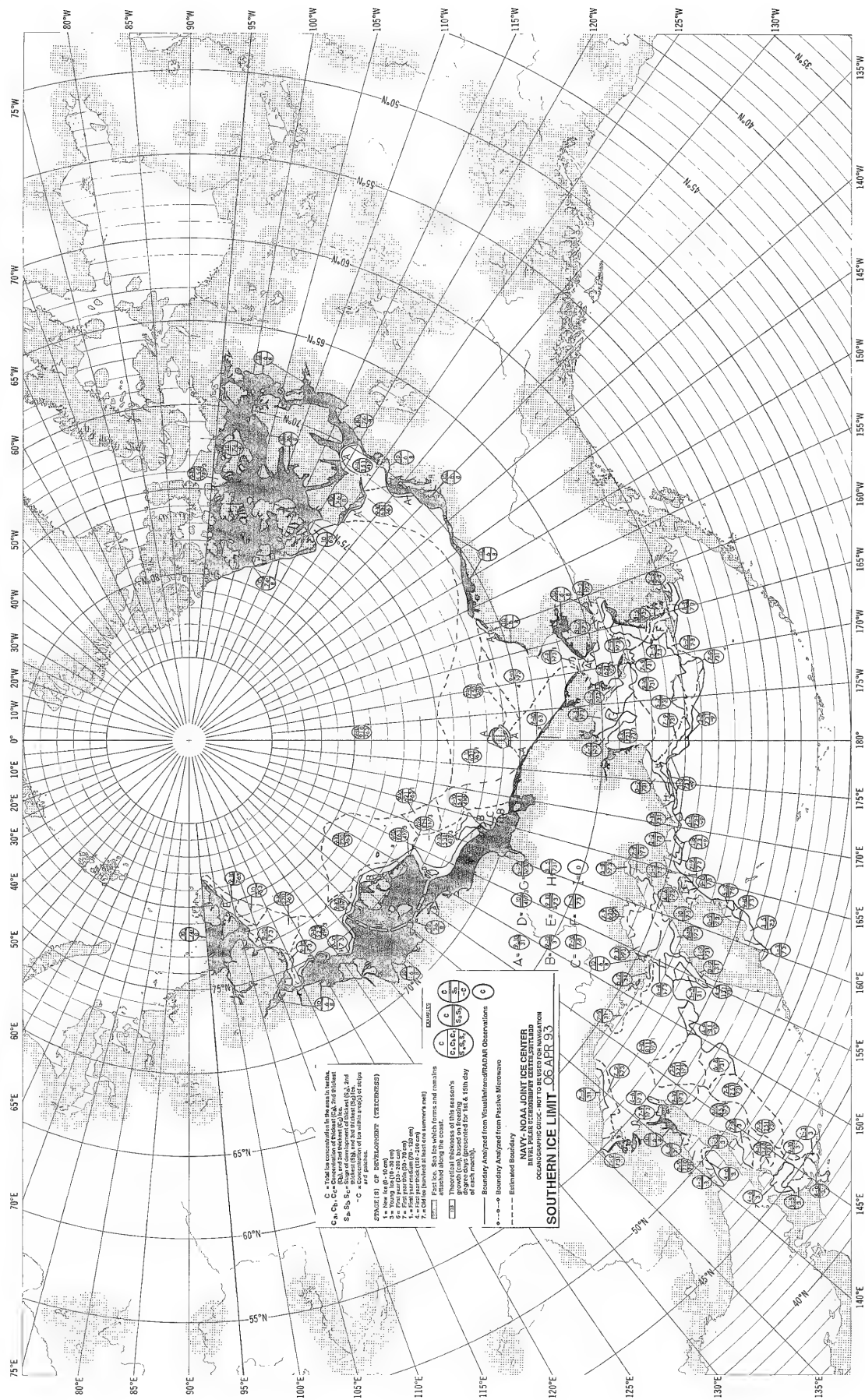


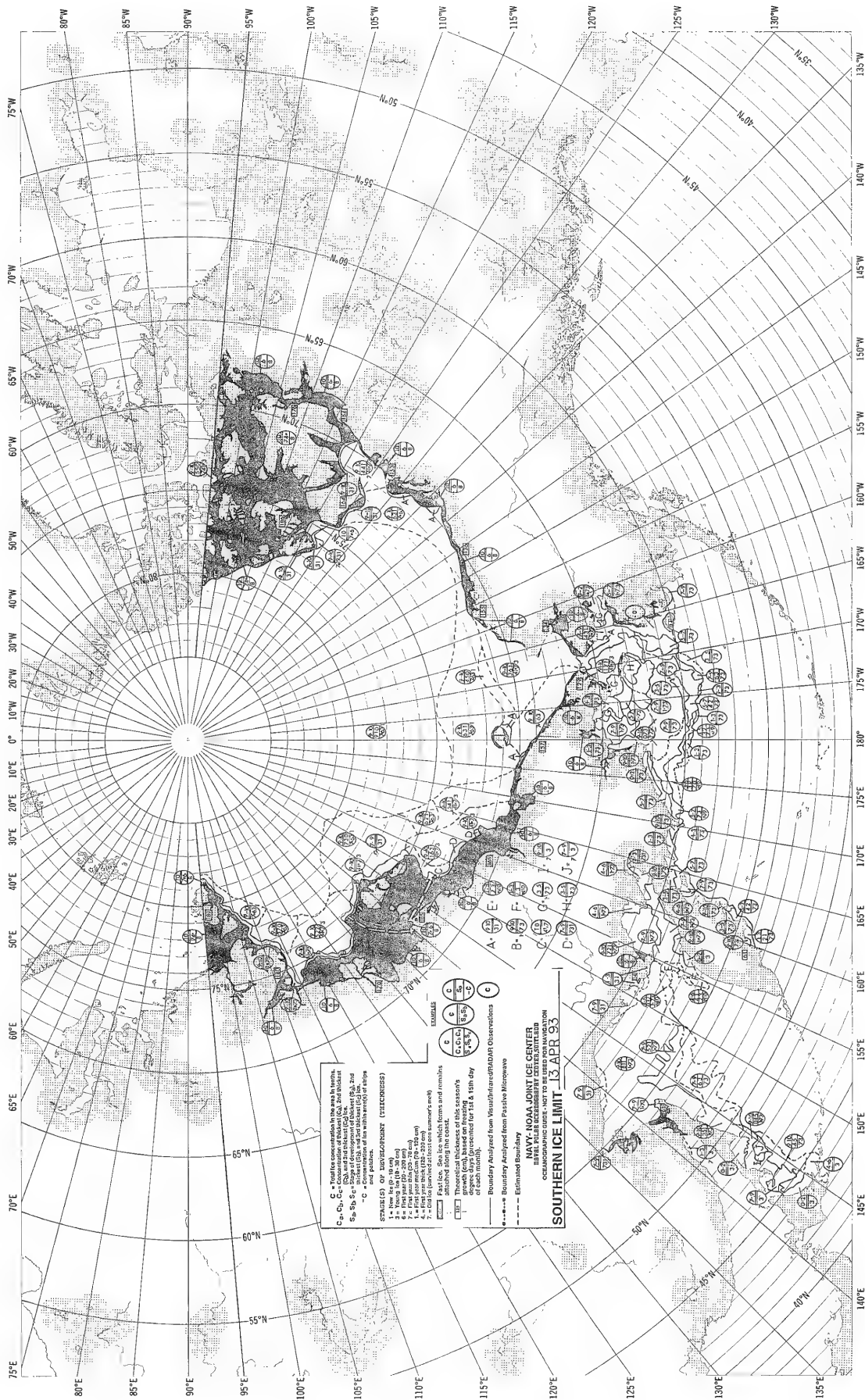


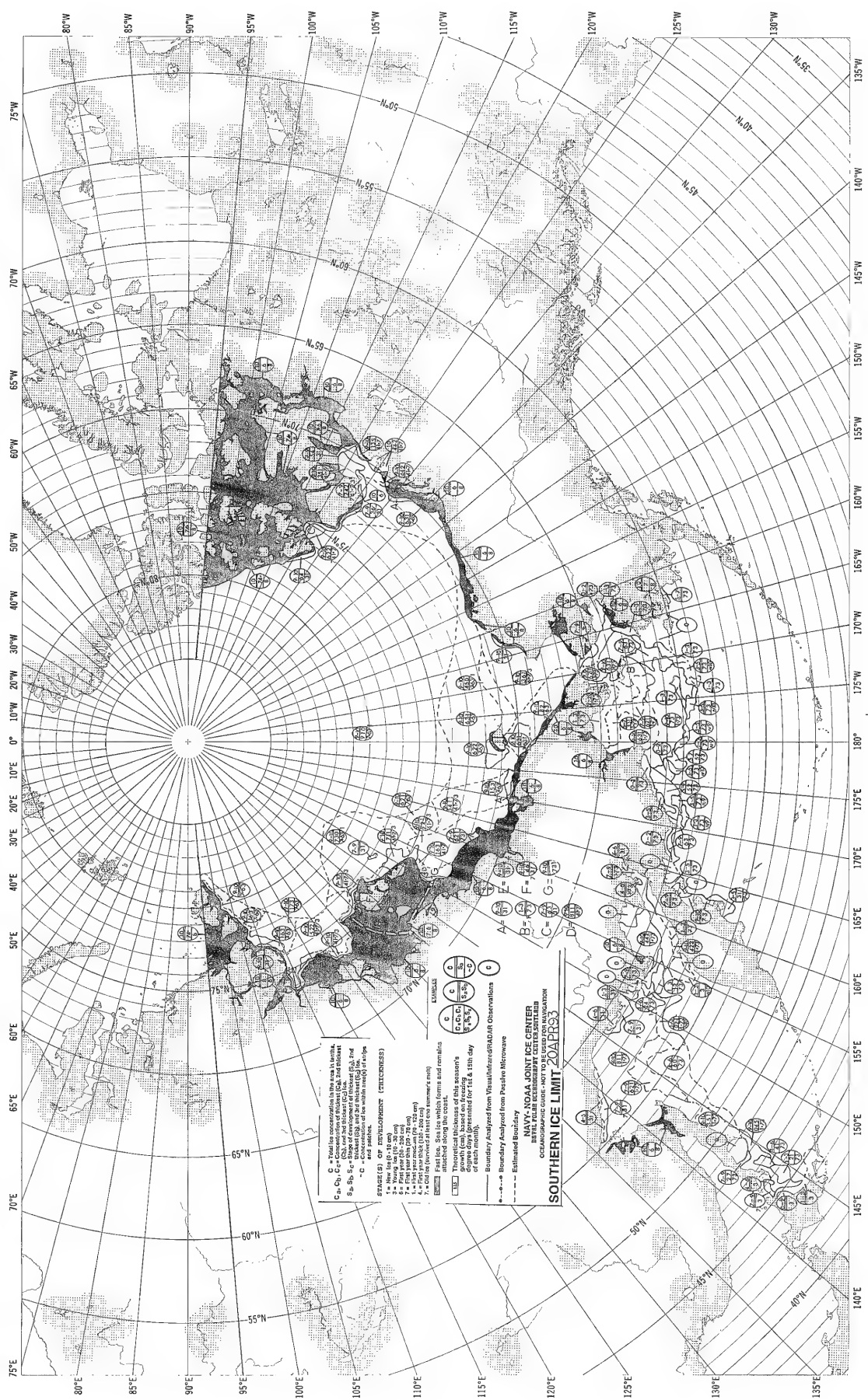


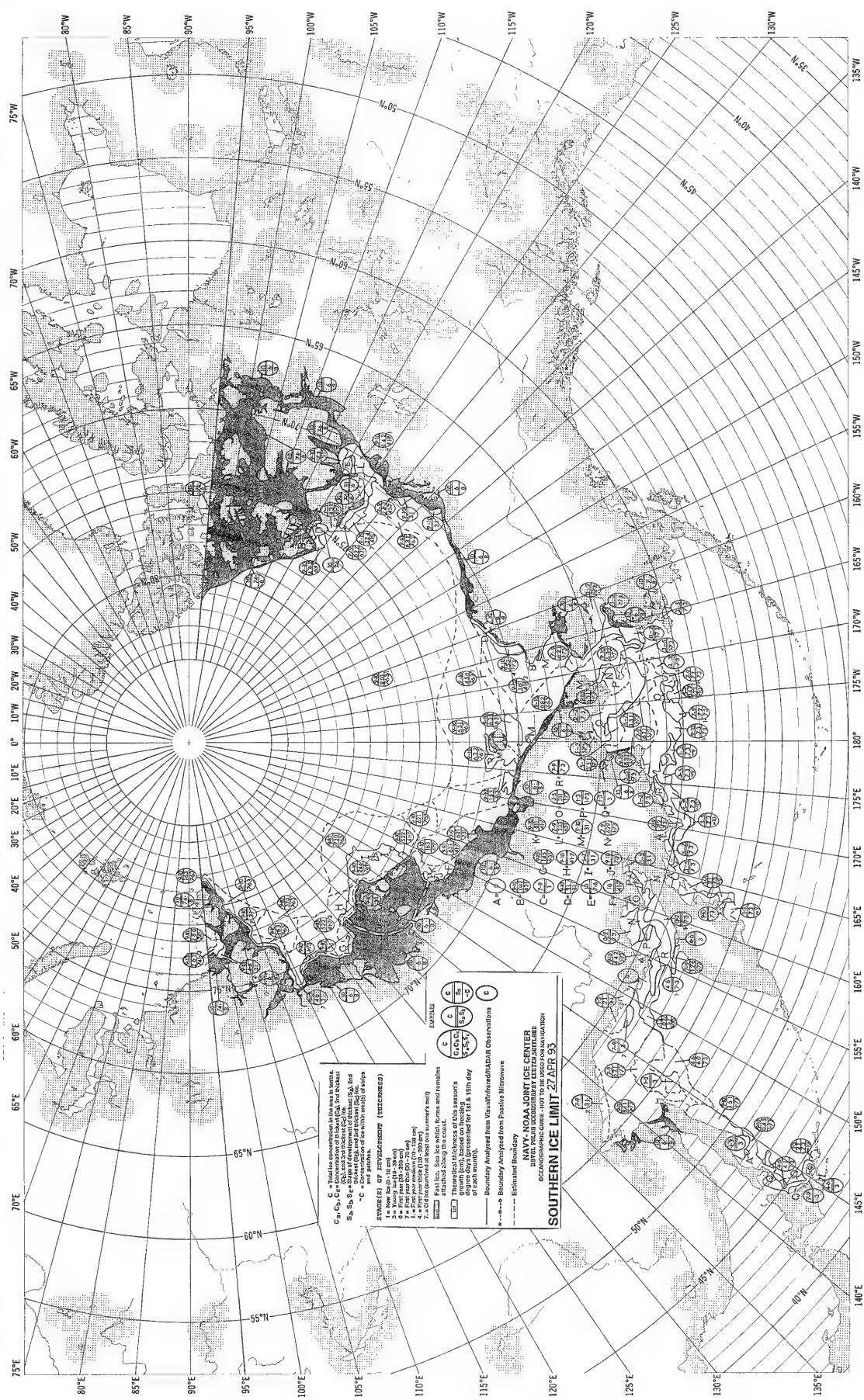


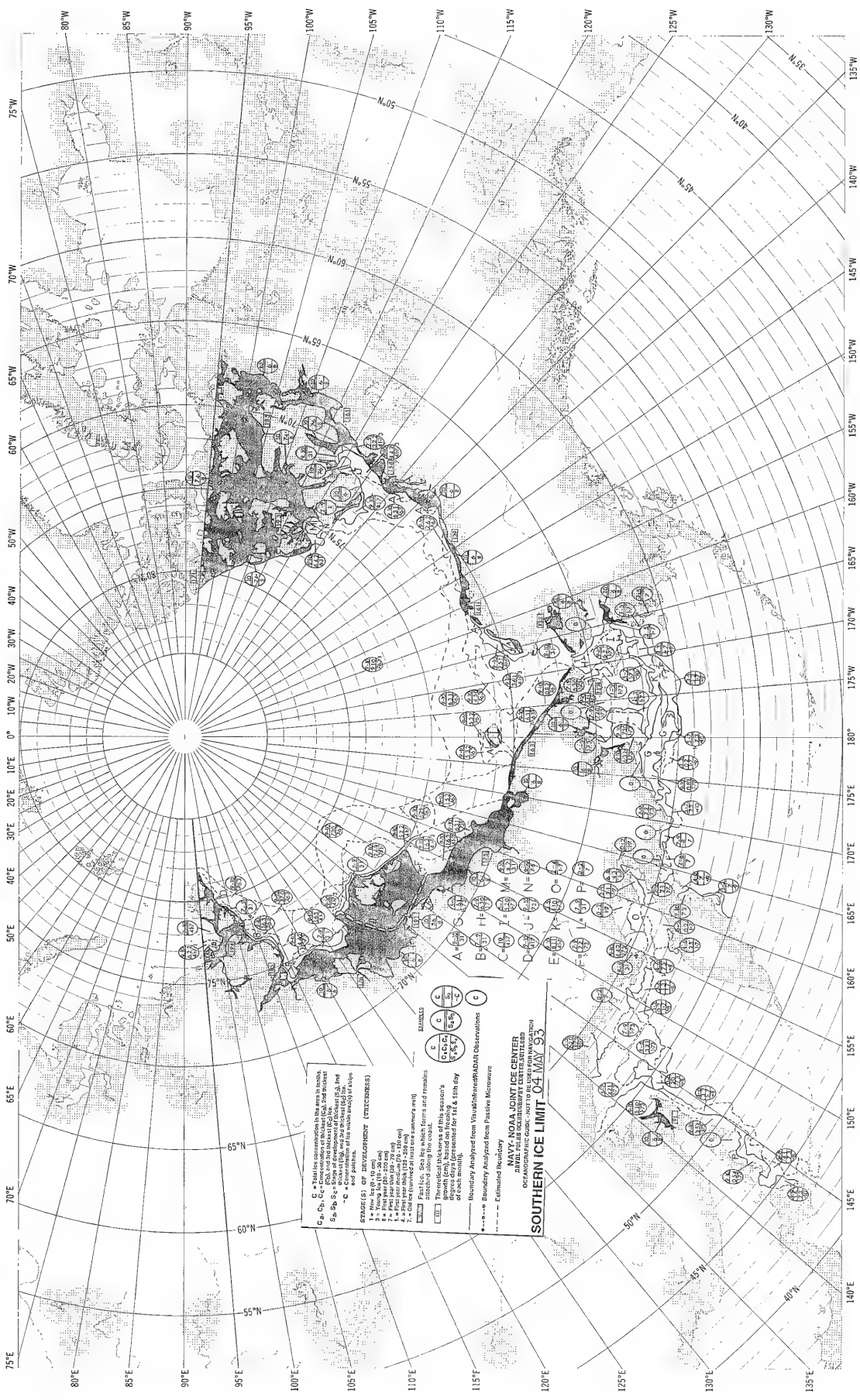












STAGES OF DEVELOPMENT (THICKNESS)

C = Total ice concentration in the area in tenths, (0-100).
C₁ = Young ice (1st - 2nd year).
C₂ = Old ice (3rd year and older).
C₃ = Ice of unknown age.
C₄ = Ice of unknown age, but not in the area of study.
C₅ = Ice of unknown age, but in the area of study.

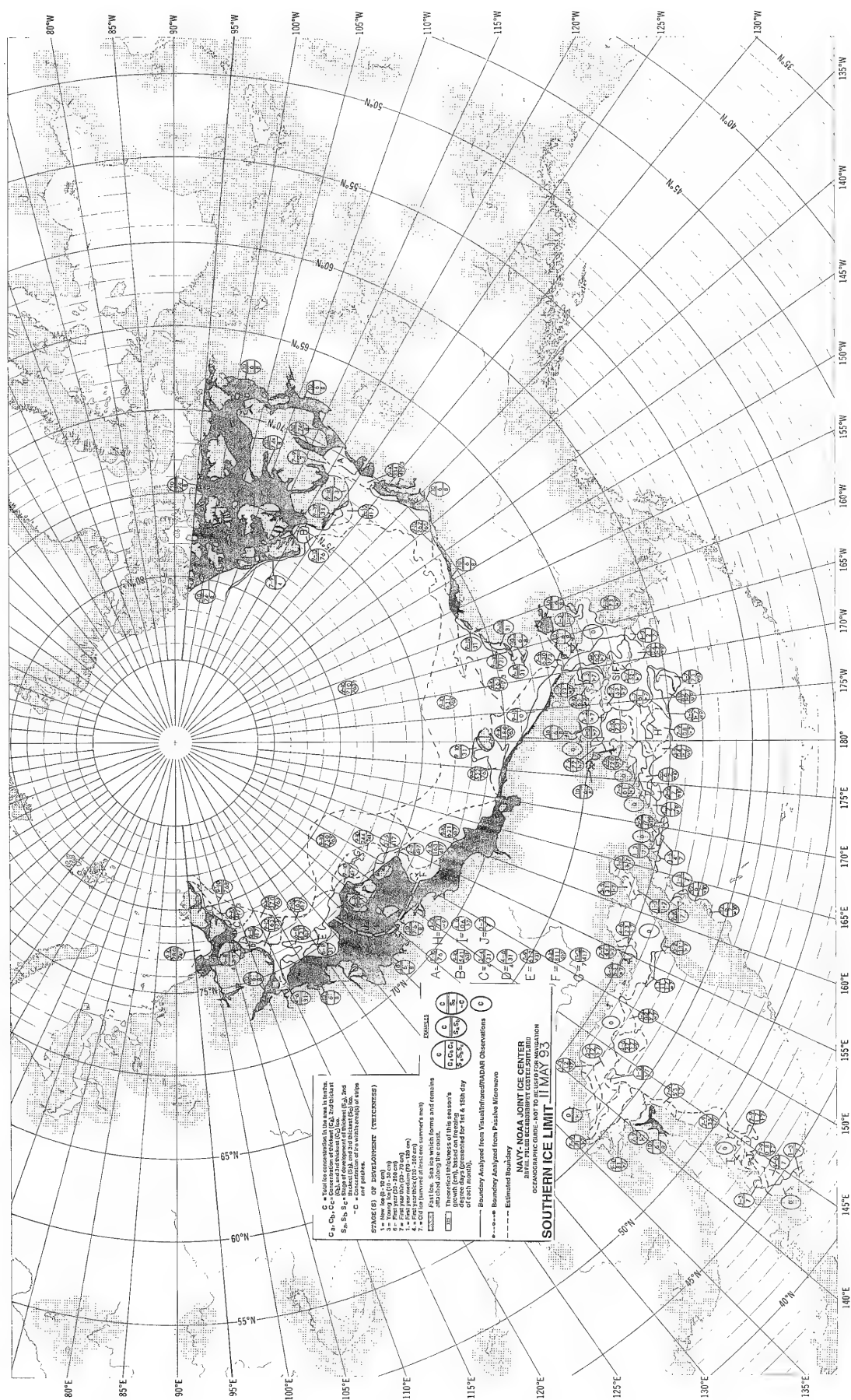
STAGES OF DEVELOPMENT (THICKNESS)

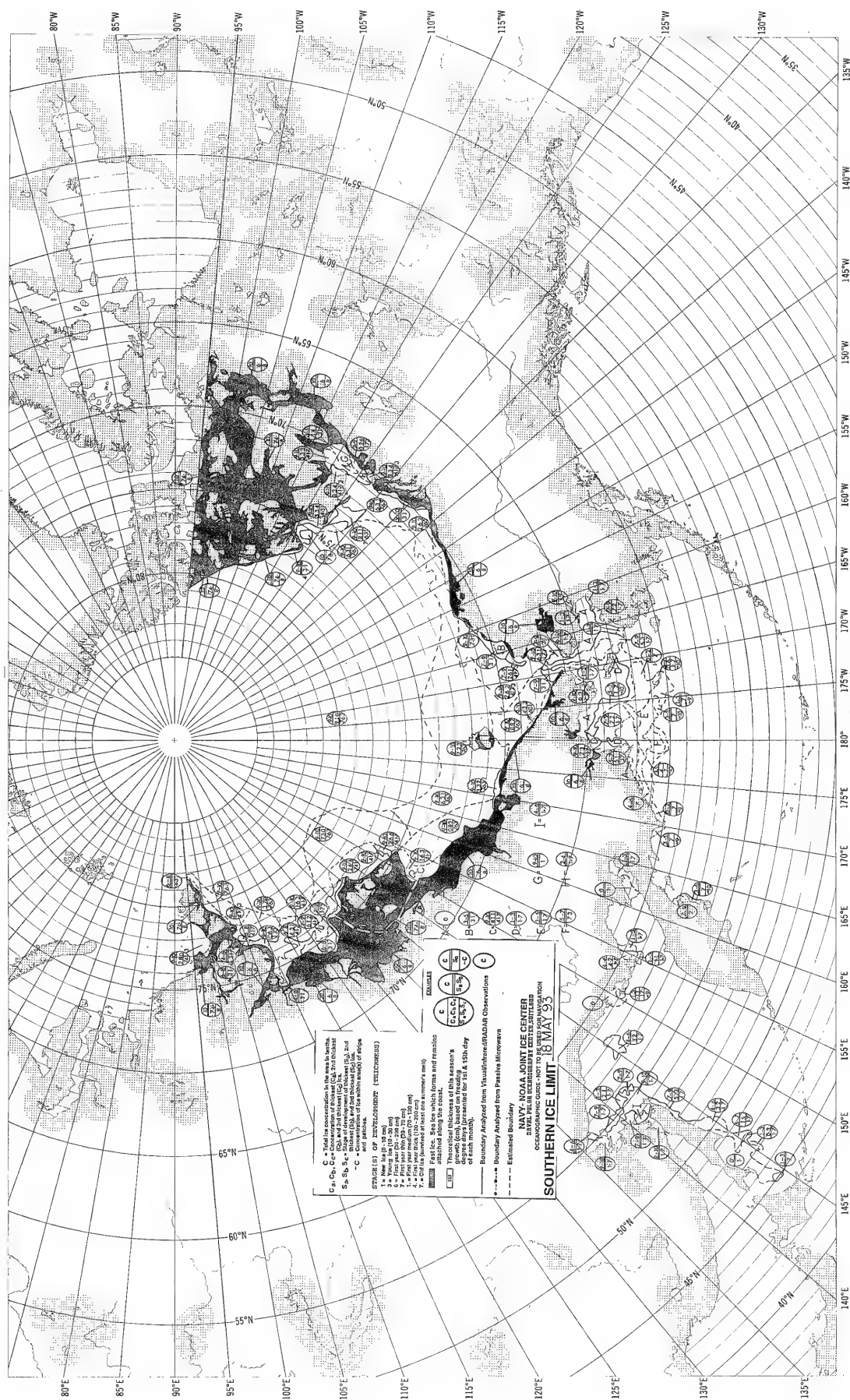
1 = Young ice (1st - 2nd year).
2 = Old ice (3rd year and older).
3 = Ice of unknown age.
4 = Ice of unknown age, but not in the area of study.
5 = Ice of unknown age, but in the area of study.

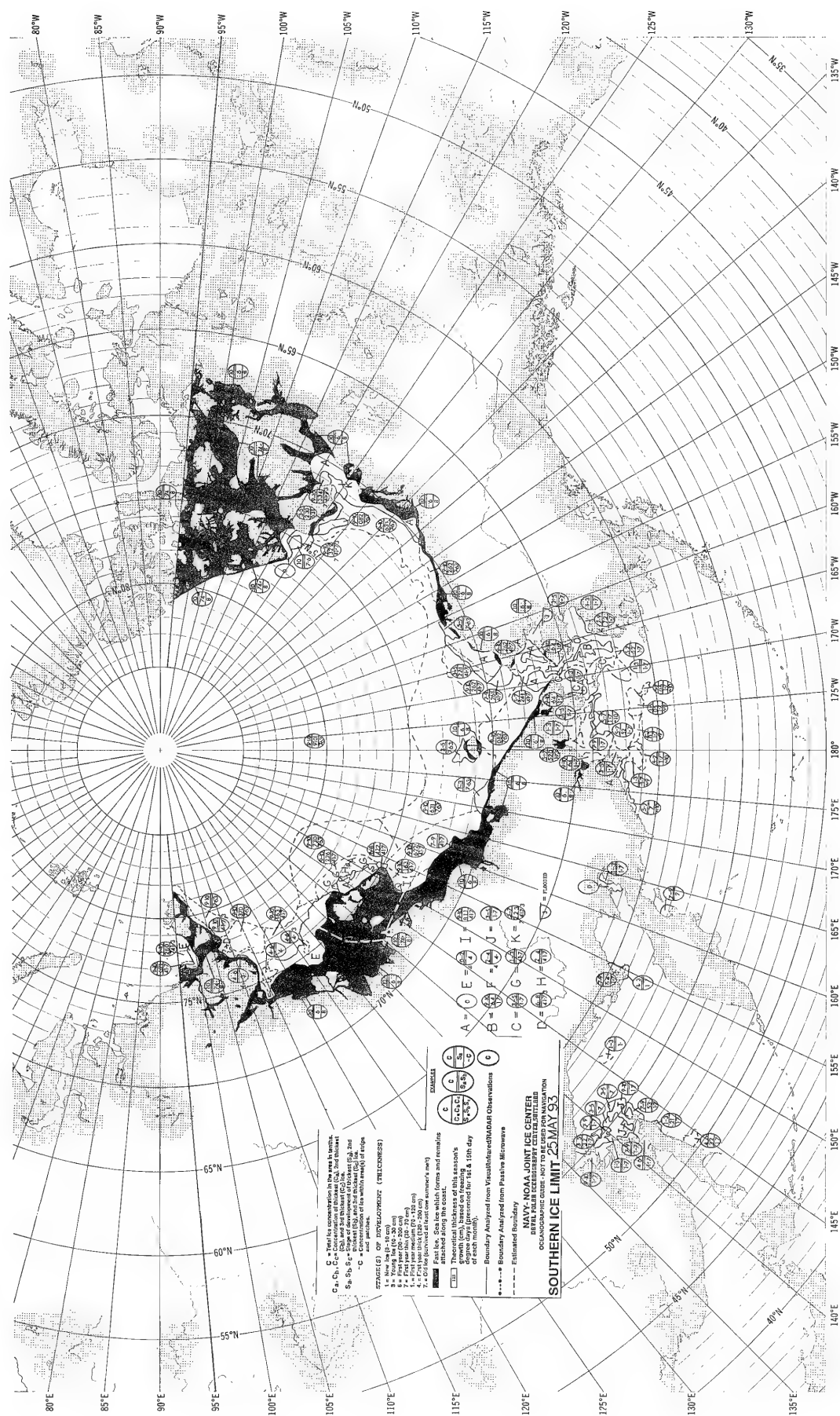
STAGES OF DEVELOPMENT (THICKNESS)

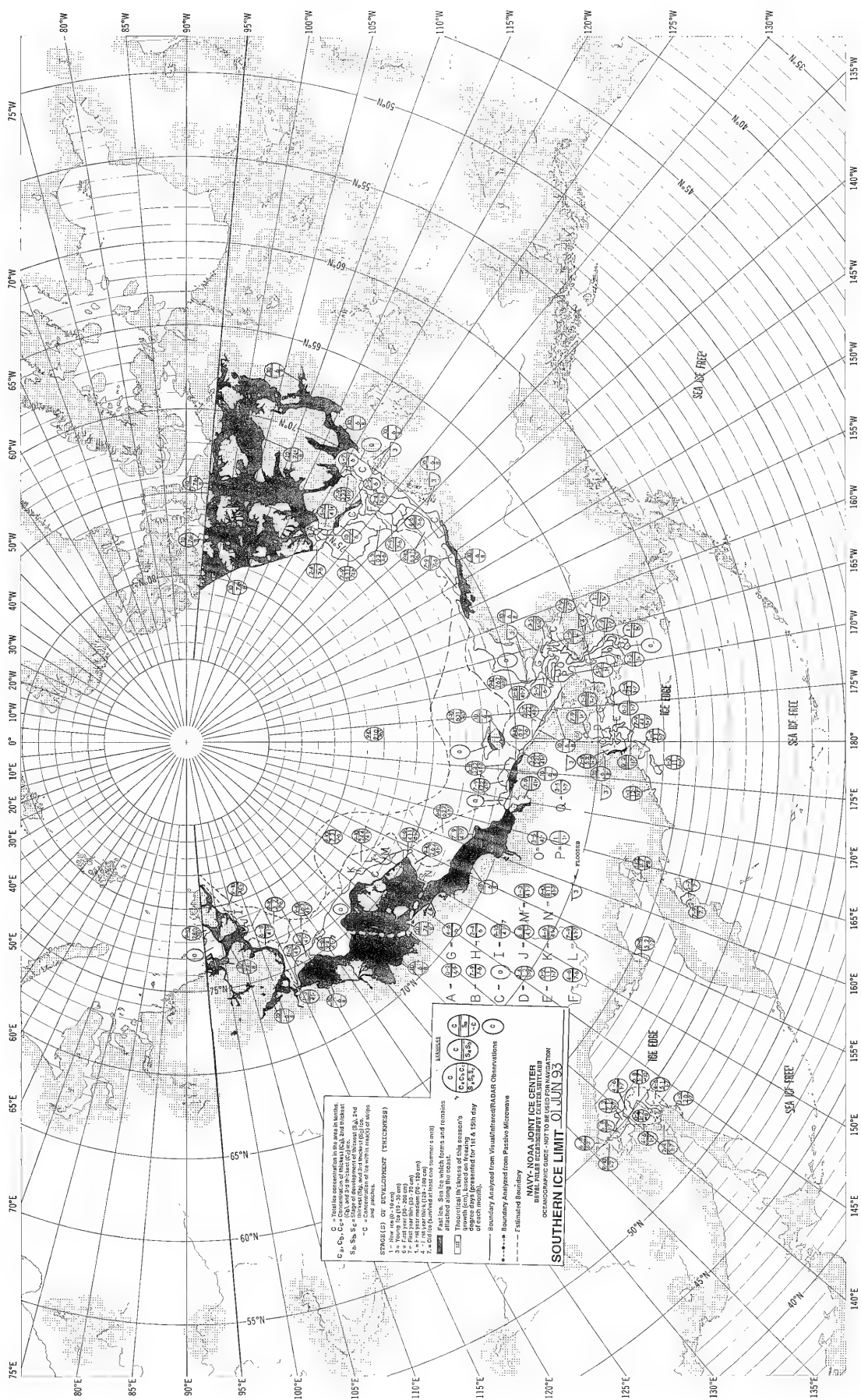
1 = Young ice (1st - 2nd year).
2 = Old ice (3rd year and older).
3 = Ice of unknown age.
4 = Ice of unknown age, but not in the area of study.
5 = Ice of unknown age, but in the area of study.

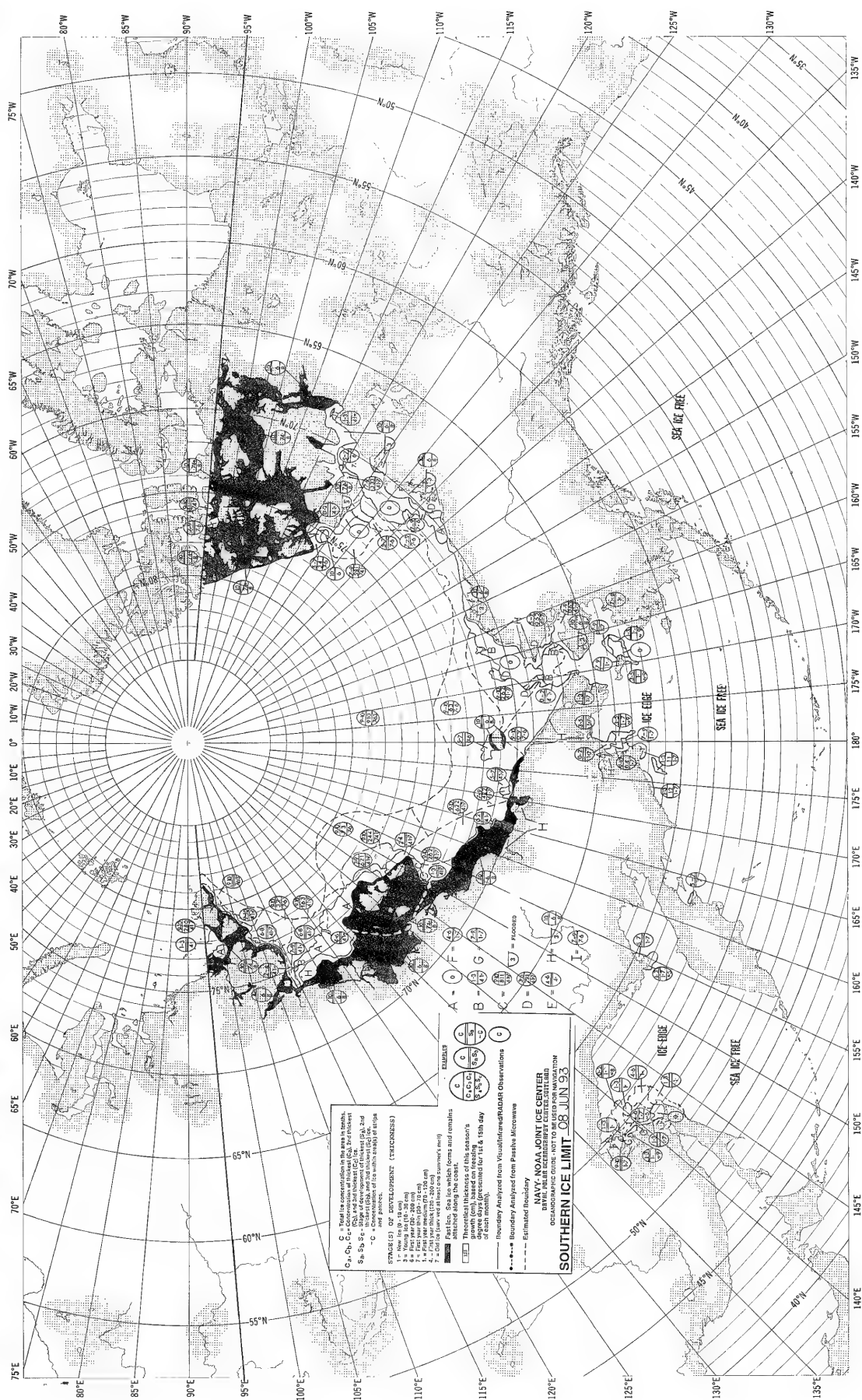
NAVY-NOAA JOINT ICE CENTER
OCEANOGRAPHIC UNIT, NOT TO BE USED FOR MARITIME
SOUTHERN ICE LIMIT 04 MAY 93

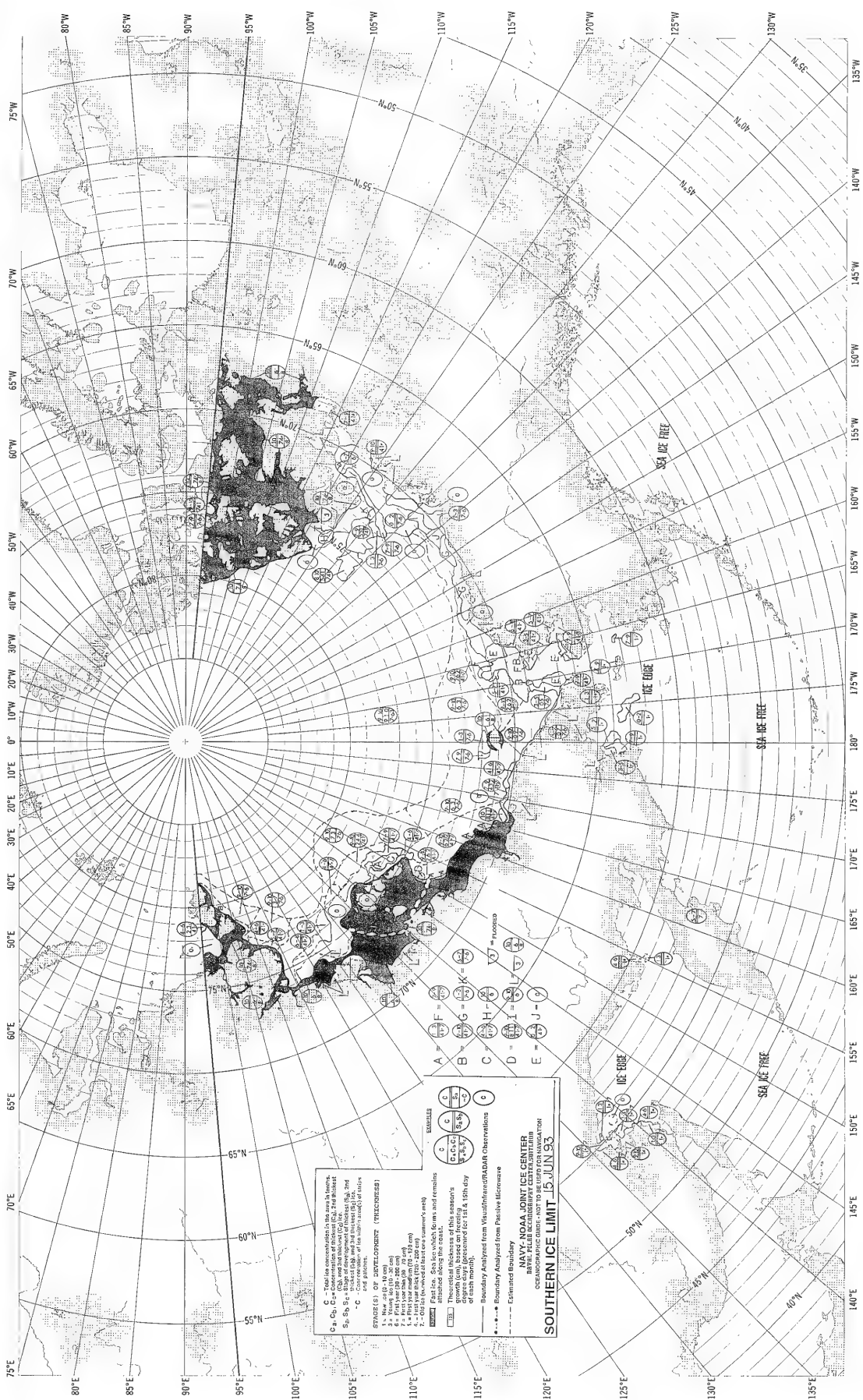


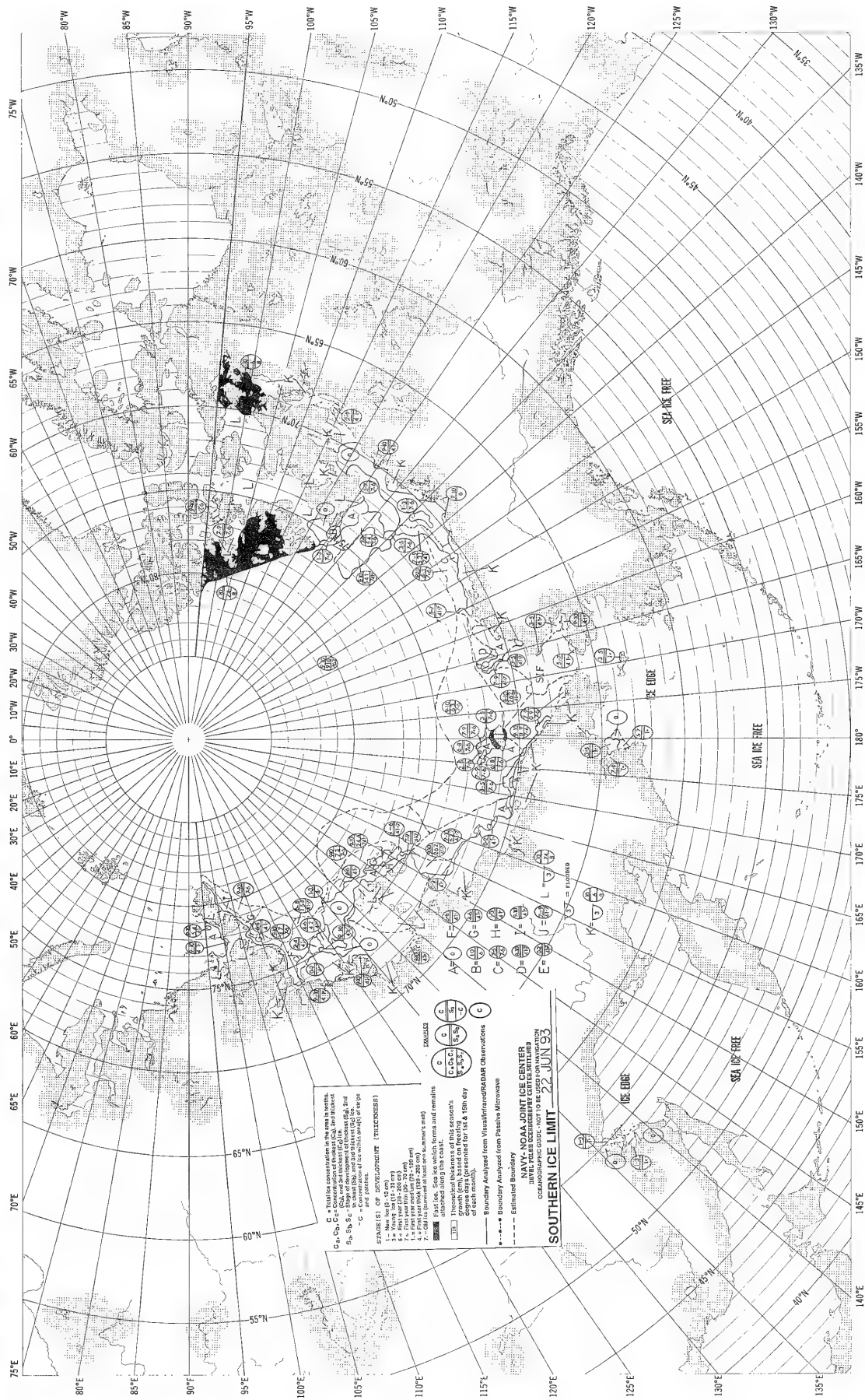


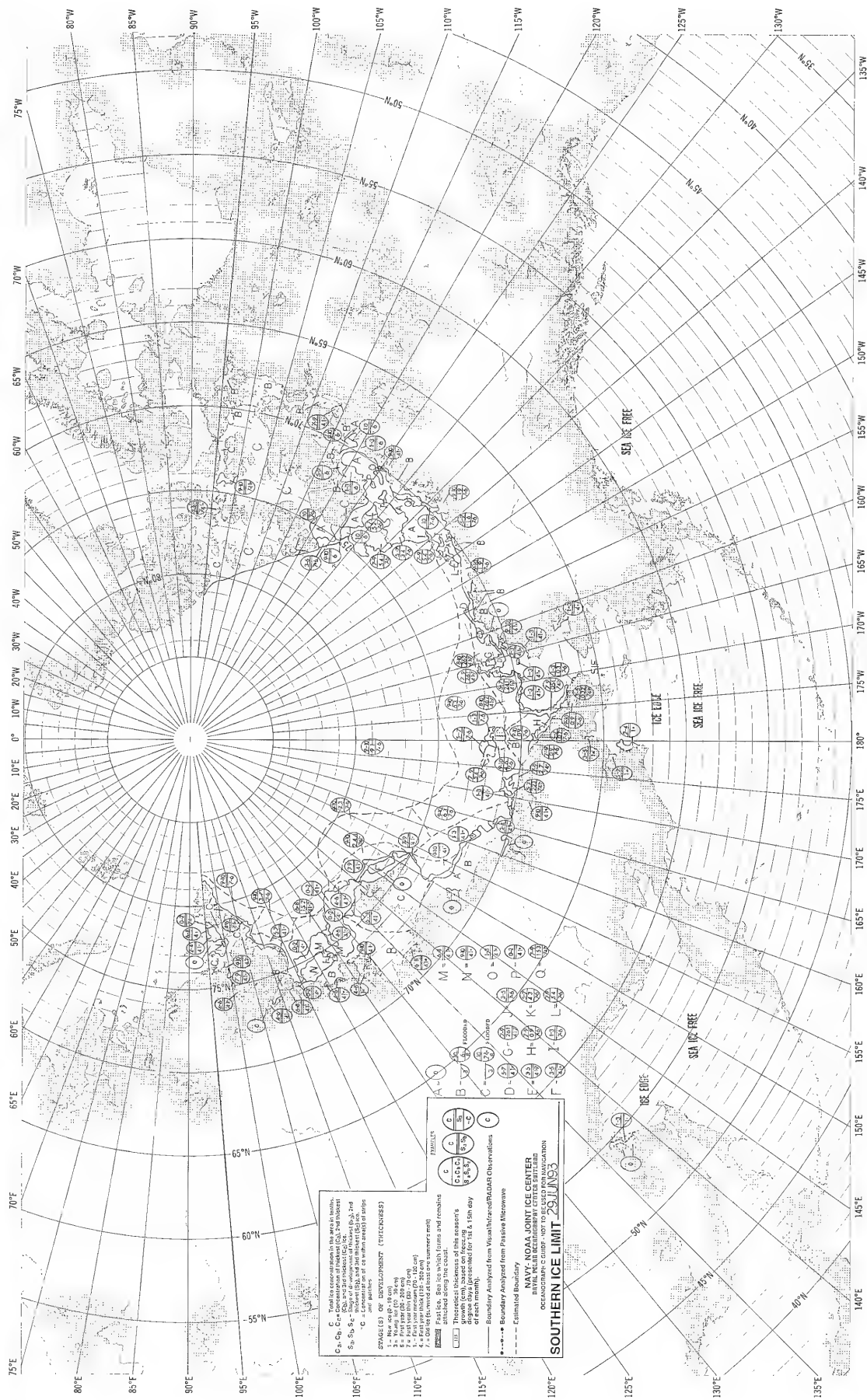


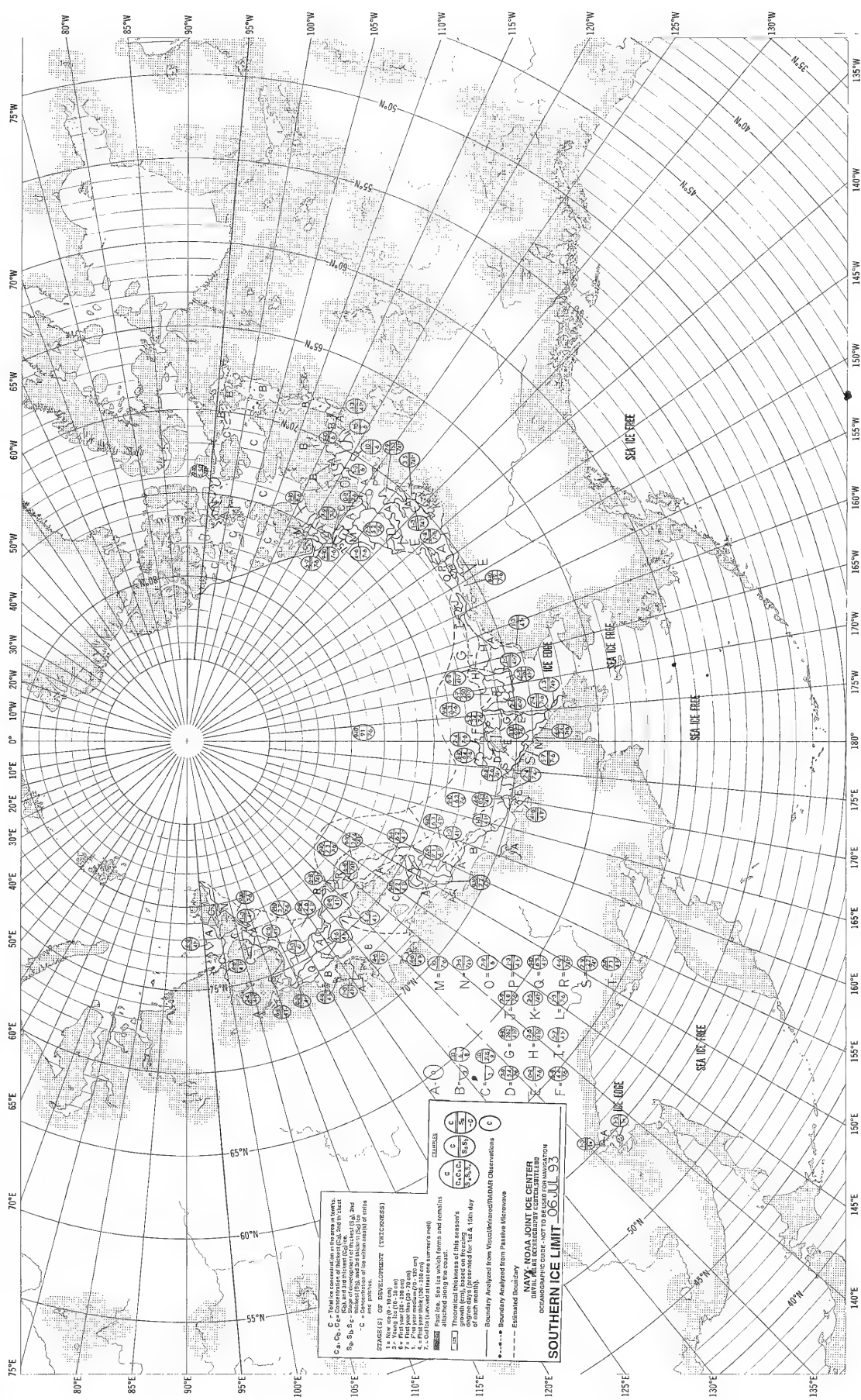


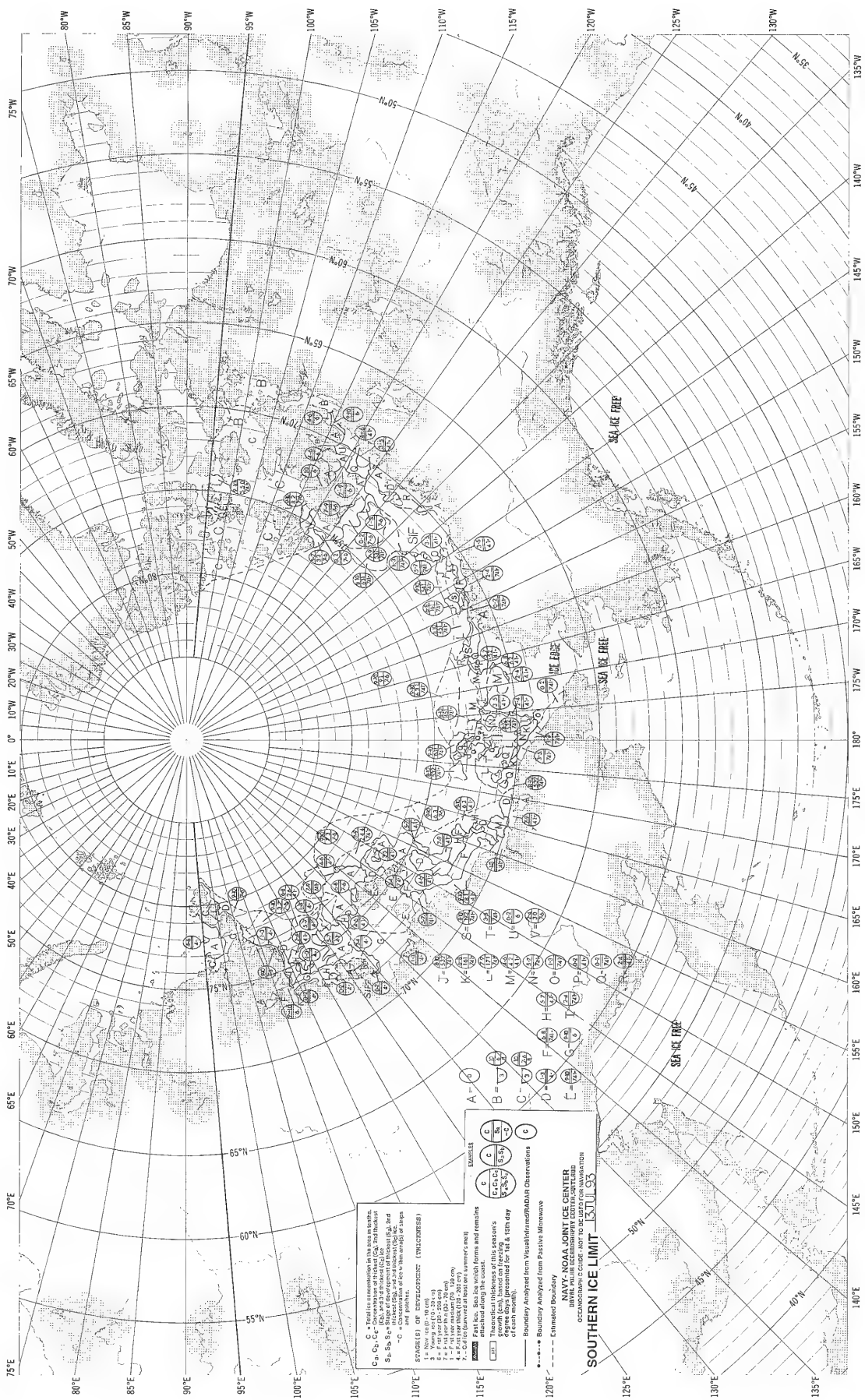












C = Total ice concentration in this area in tenths.
C₁, C₂, C₃ = C₁ and C₂ and C₃ are tenths of ice thickness.
S₁, S₂, S₃ = S₁ and S₂ and S₃ are tenths of ice thickness.
C₁, C₂, C₃ = C₁ and C₂ and C₃ are tenths of ice thickness.
S₁, S₂, S₃ = S₁ and S₂ and S₃ are tenths of ice thickness.

STAGES OF DEVELOPMENT (TENTHES)

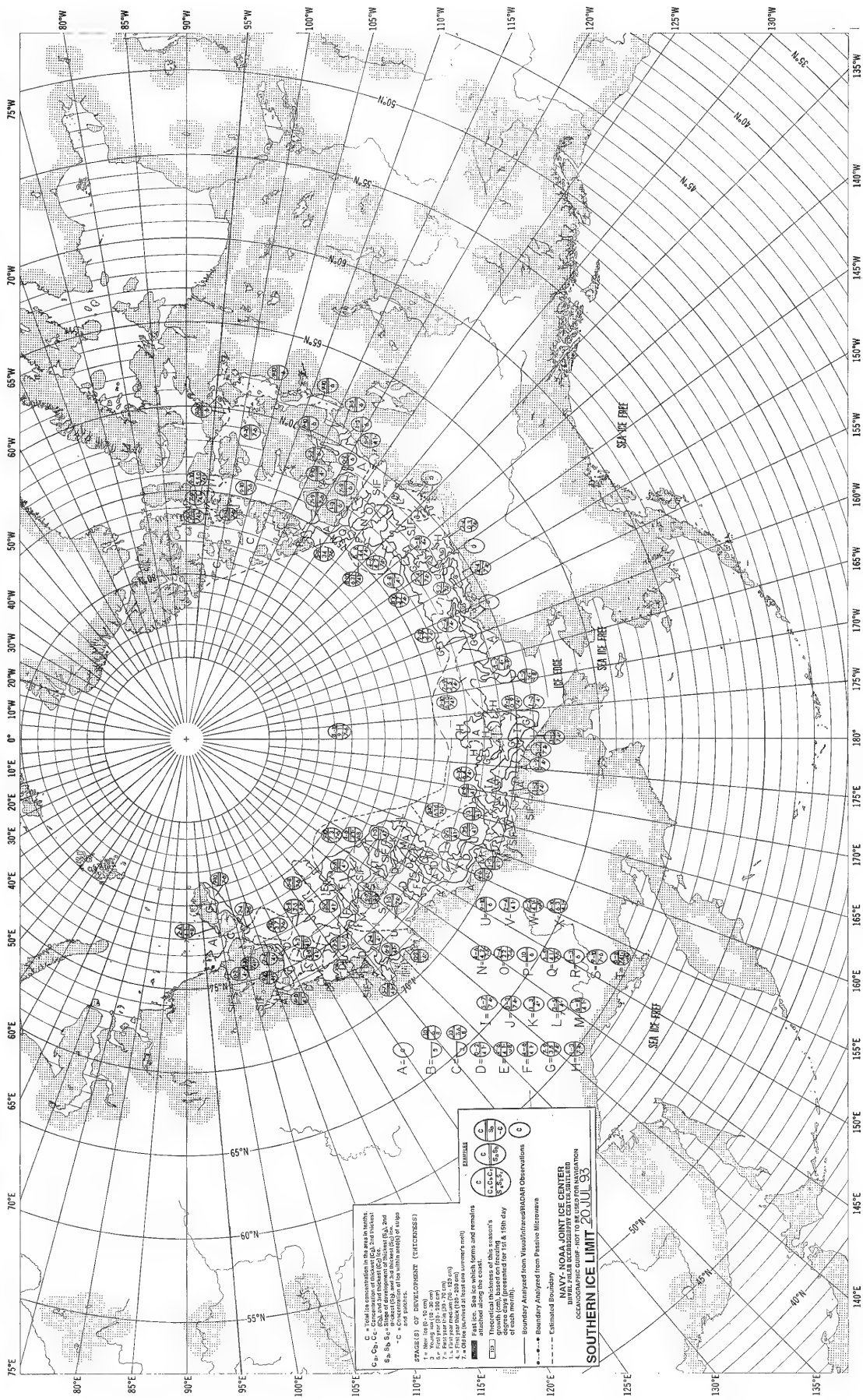
1 = New ice (1st year)
2 = First year ice (1st year)
3 = First year ice (2nd year)
4 = First year ice (3rd year)
5 = First year ice (4th year)
6 = First year ice (5th year)
7 = First year ice (6th year)
8 = First year ice (7th year)
9 = First year ice (8th year)
10 = First year ice (9th year)
11 = First year ice (10th year)

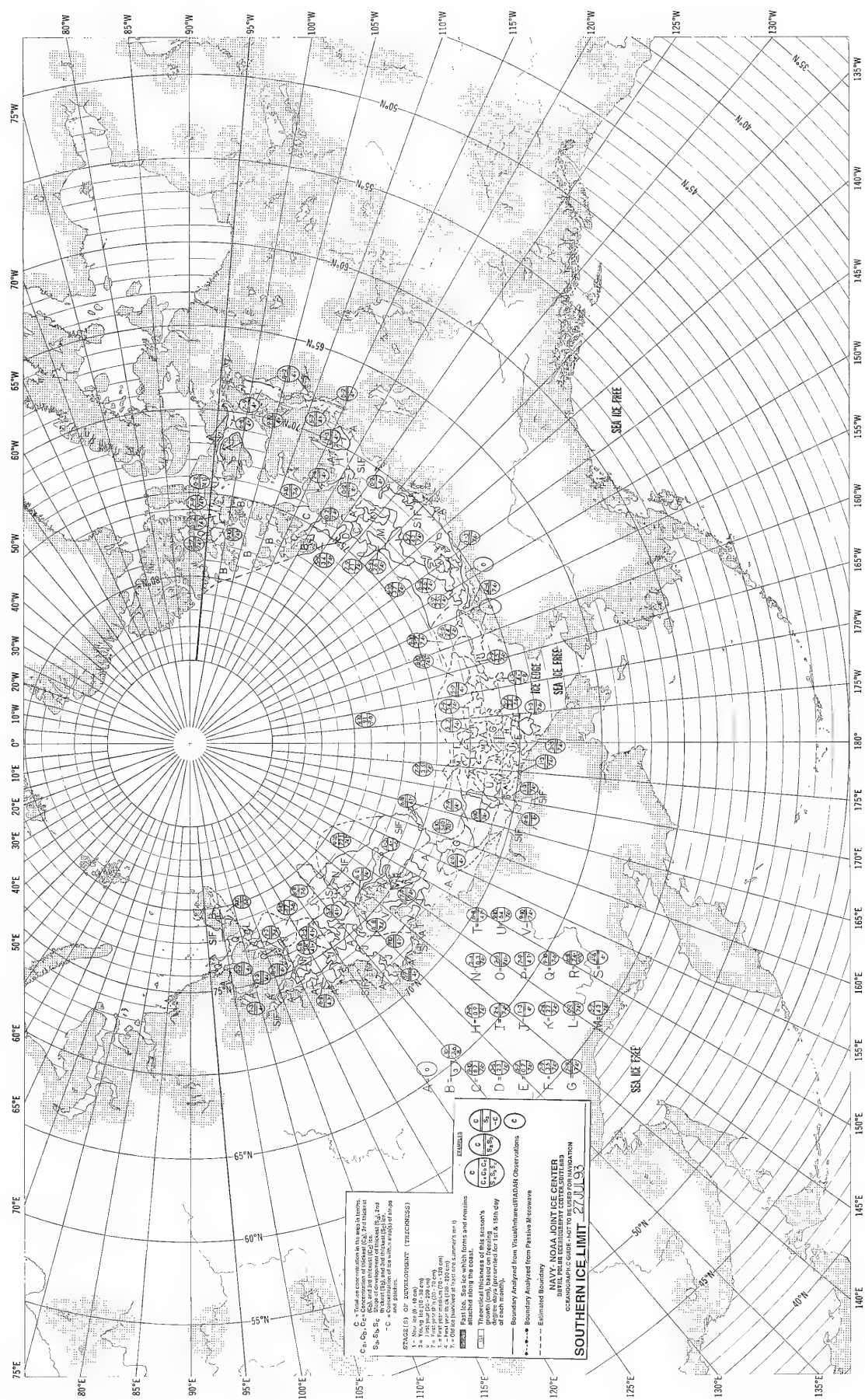
EXAMPLES

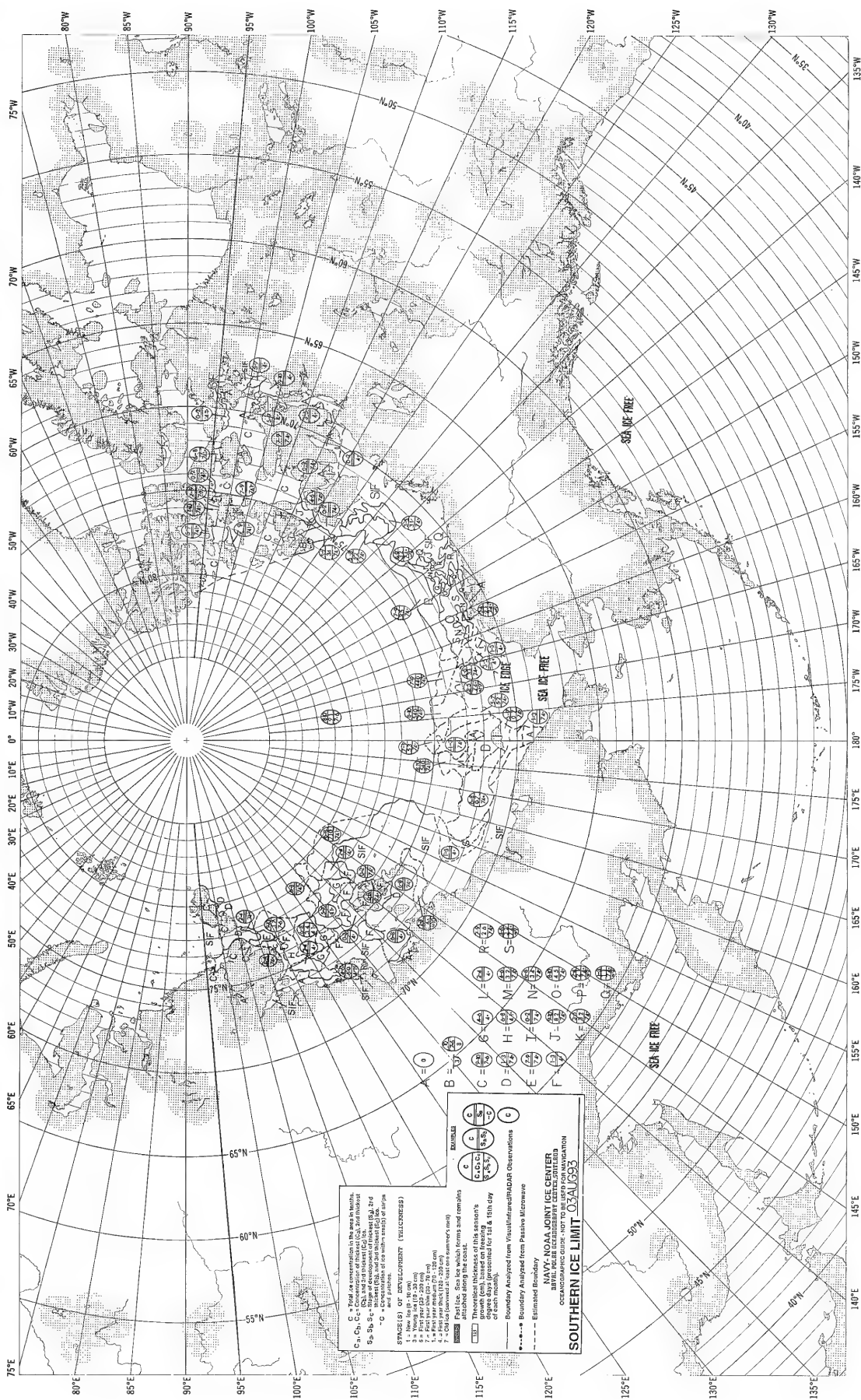
A = $\frac{C}{S}$
B = $\frac{C}{S}$
C = $\frac{C}{S}$
D = $\frac{C}{S}$
E = $\frac{C}{S}$
F = $\frac{C}{S}$
G = $\frac{C}{S}$
H = $\frac{C}{S}$
I = $\frac{C}{S}$
J = $\frac{C}{S}$
K = $\frac{C}{S}$
L = $\frac{C}{S}$
M = $\frac{C}{S}$
N = $\frac{C}{S}$
O = $\frac{C}{S}$
P = $\frac{C}{S}$
Q = $\frac{C}{S}$
R = $\frac{C}{S}$
S = $\frac{C}{S}$
T = $\frac{C}{S}$
U = $\frac{C}{S}$
V = $\frac{C}{S}$
W = $\frac{C}{S}$
X = $\frac{C}{S}$
Y = $\frac{C}{S}$
Z = $\frac{C}{S}$

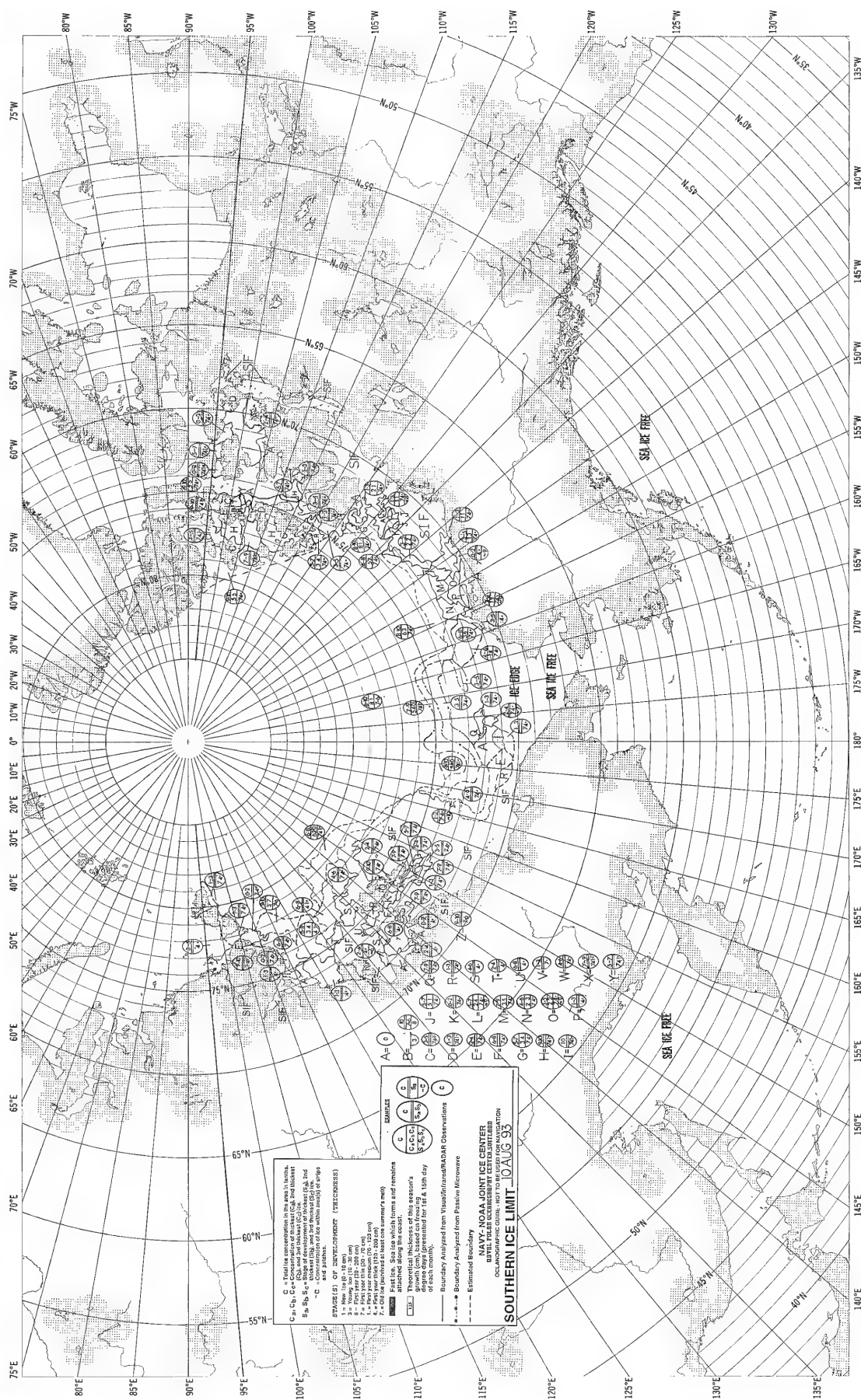
Boundary Analyzed from Visual/Microwave Observations
--- Estimated Boundary

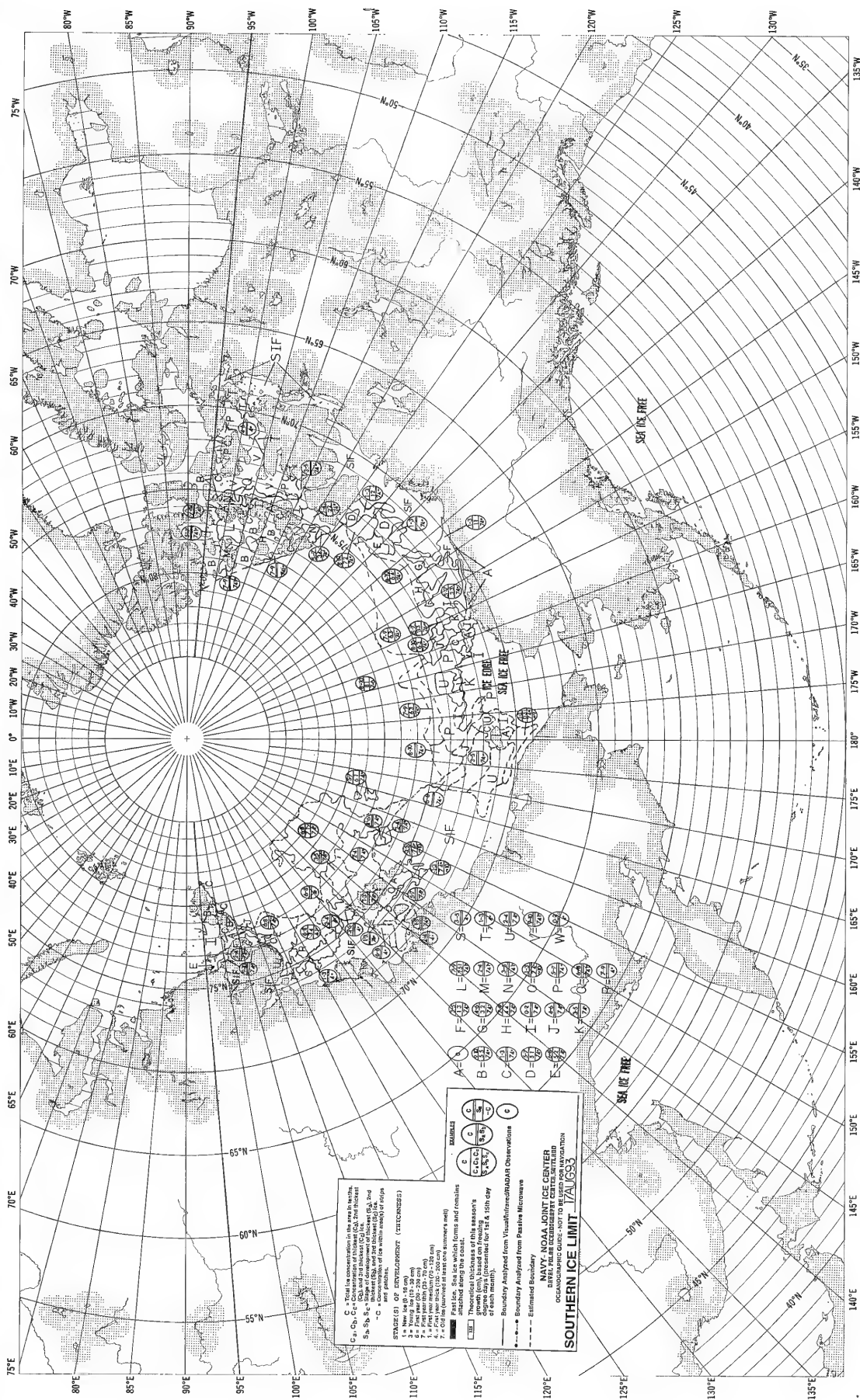
NAVY - NOAA JOINT ICE CENTER
OCCANOGRAPHIC CODE - NOT TO BE USED FOR NAVIGATION
SOUTHERN ICE LIMIT - 135°E

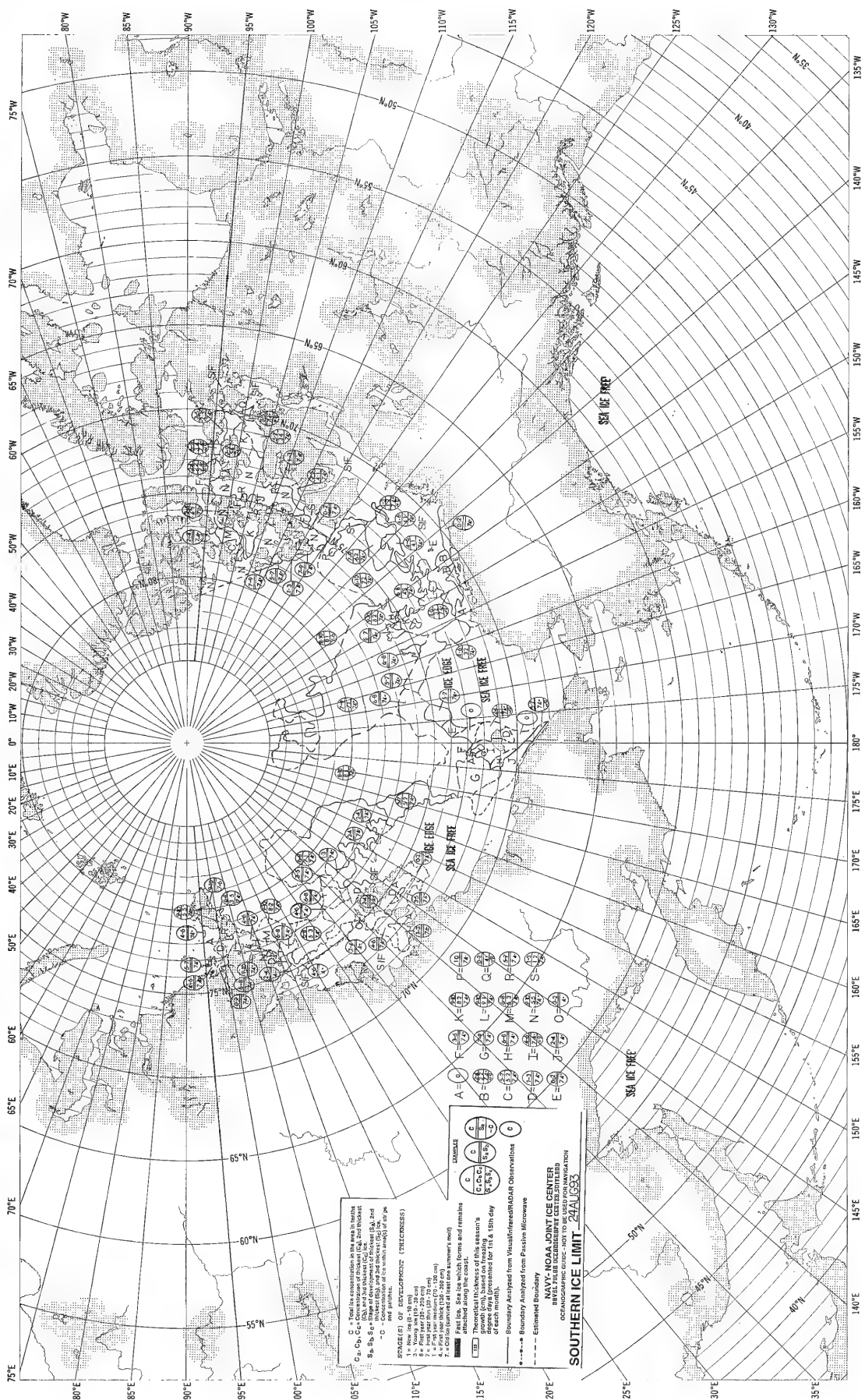












C = Total ice concentration in the area in tenths
 G, L, C, S, O, A, and B are used for ice types: G, L, and B are
 Sea-ice types: S is a mixture of open water and ice; O is open water
 and A and B are ice types: A is ice with a thickness of 100 cm or more
 and B is ice with a thickness of 100 cm or less

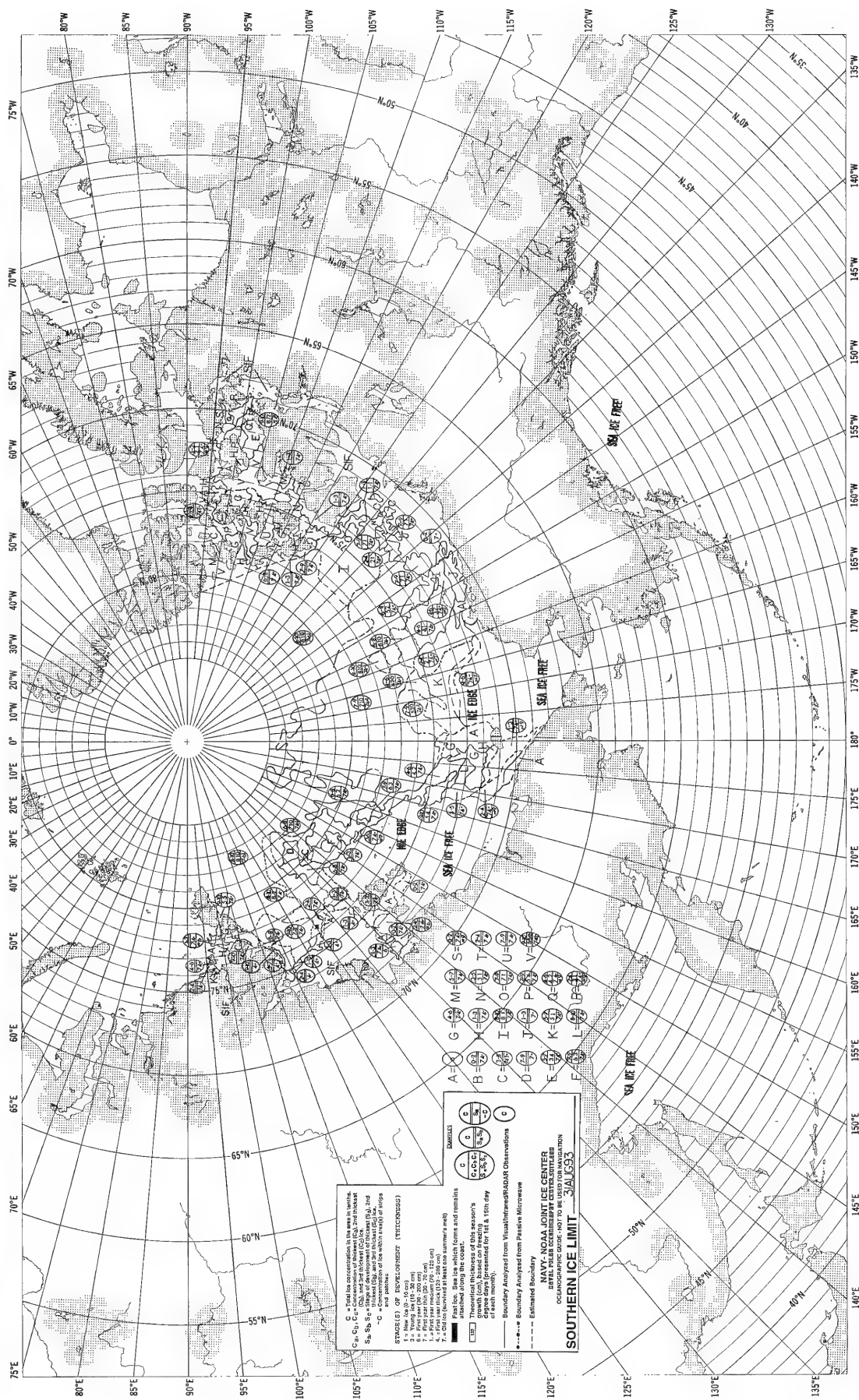
STAGES OF DEVELOPMENT (THICKNESS)
 1 = New ice (0-10 cm)
 2 = First year ice (10-15 cm)
 3 = First year ice (15-20 cm)
 4 = First year ice (20-25 cm)
 5 = First year ice (25-30 cm)
 6 = First year ice (30-35 cm)
 7 = Old ice (35 cm or more at last summer's melt)

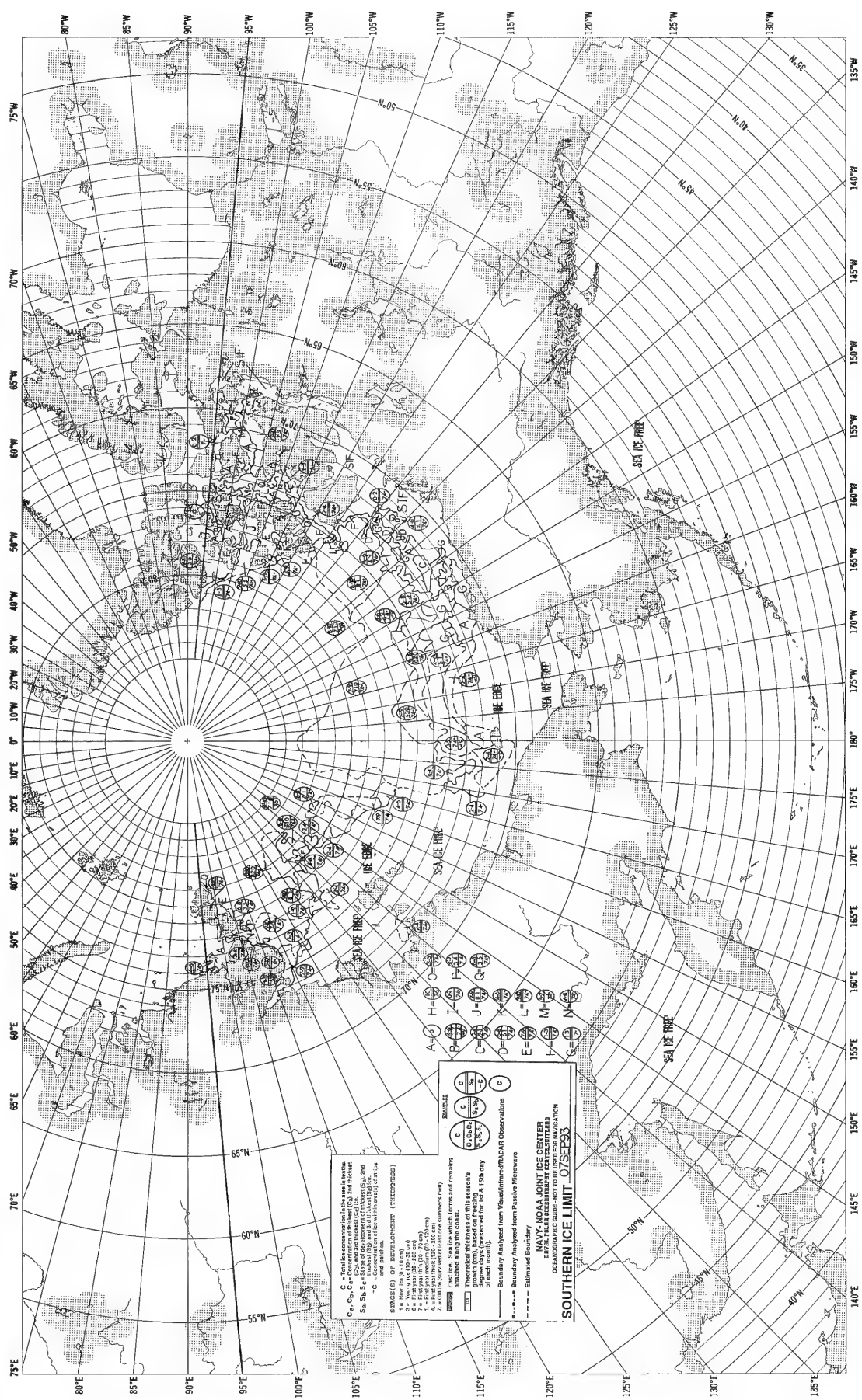
Fast ice: Sea ice which forms and remains
 attached to the coast or to a fixed object
 (icebergs, ice floes, ice fields, ice fields
 and ice fields, based on freezing
 conditions for 14 & 18th day
 of each month)

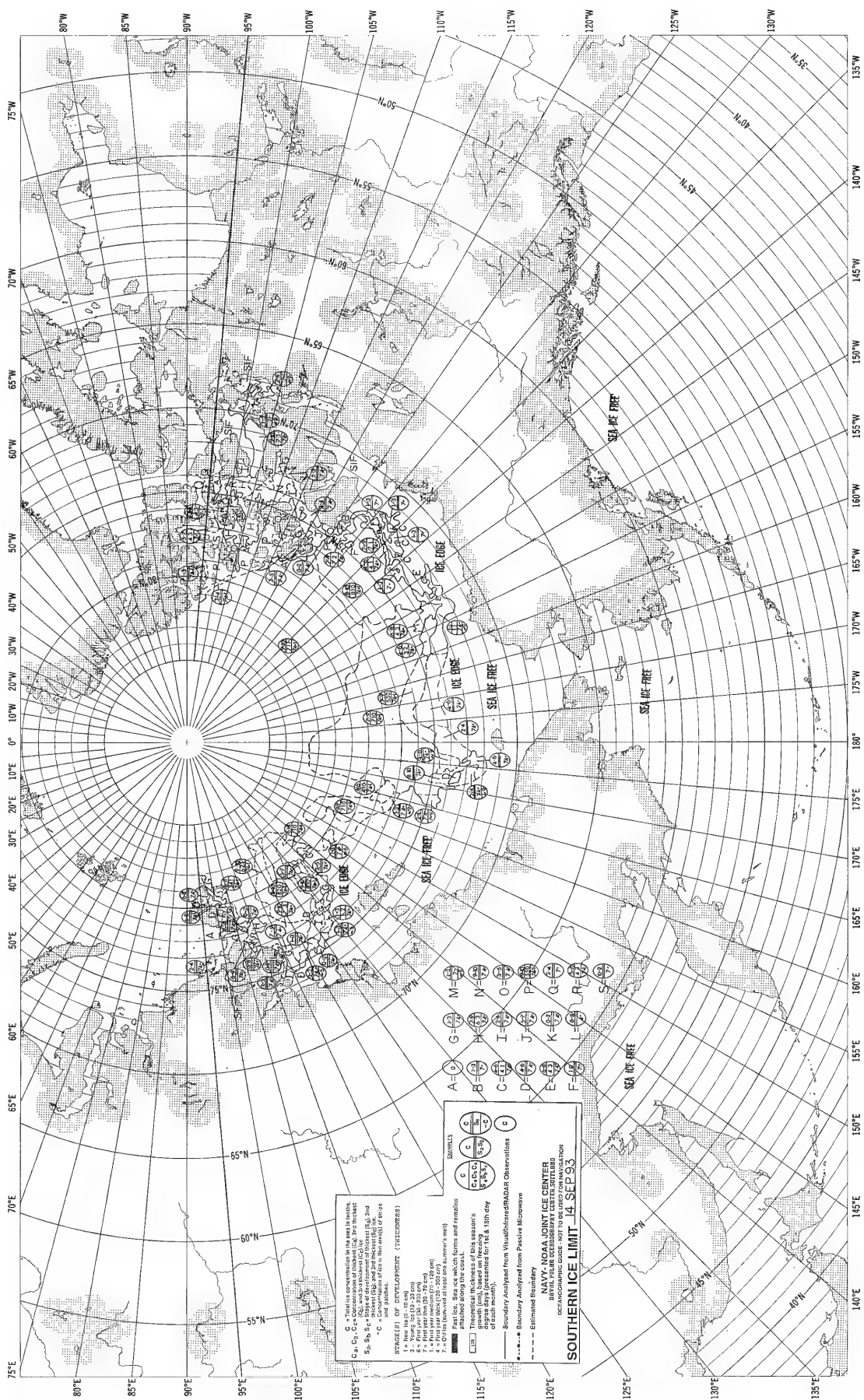
Boundary Analyzed from Visual/Radar Observations
 Boundary Analyzed from Passive Microwave
 Estimated Boundary

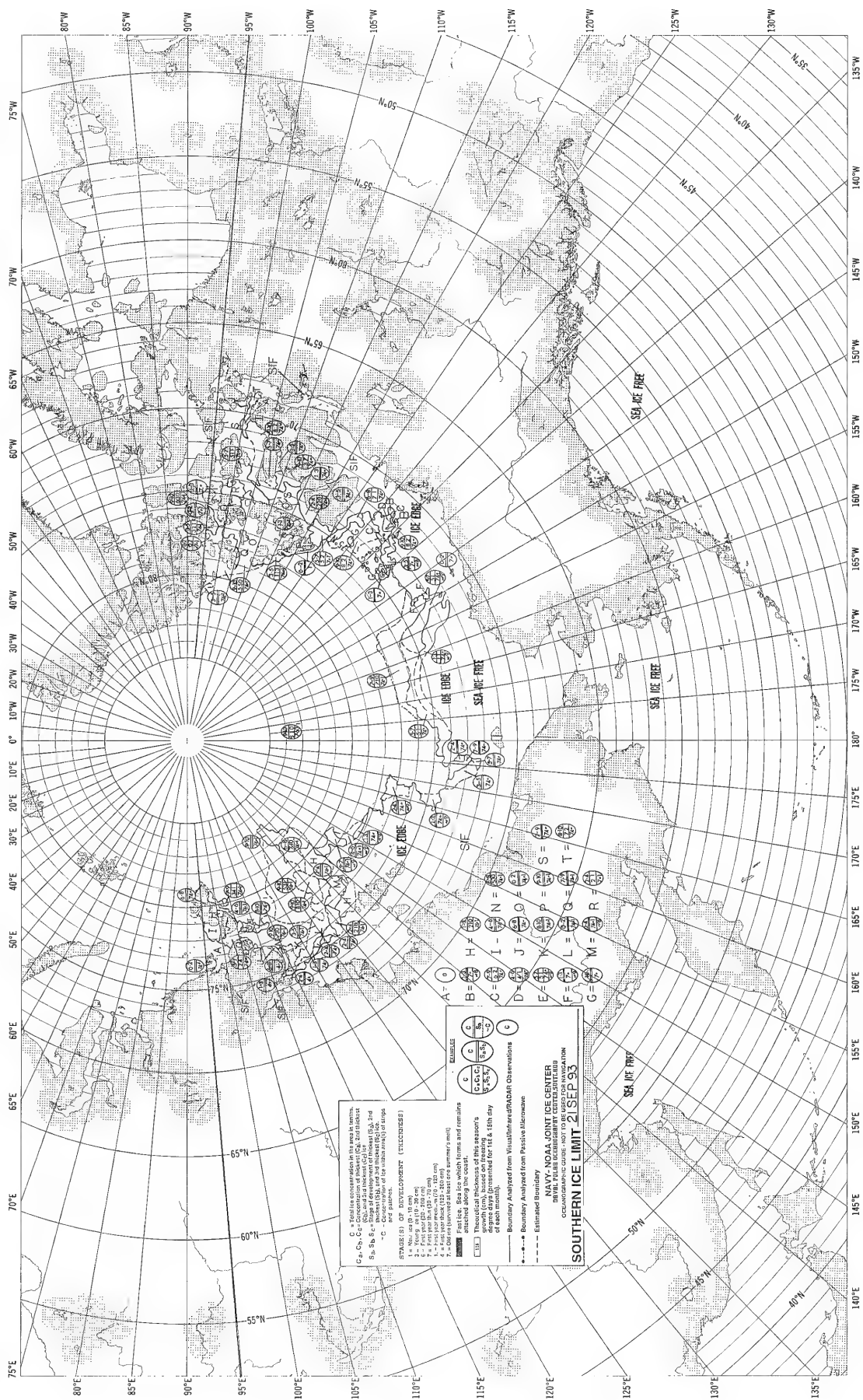
NAVY-NOAA JOINT ICE CENTER
 1000 EAST 12TH AVENUE
 OCEANOGRAPHIC GUIDE-NAVY-NOAA JOINT ICE CENTER
 SOUTHERN ICE LIMIT 24 JUL 1993

Symbol	Meaning
A = 10	Ice with a thickness of 100 cm or more
B = 10	Ice with a thickness of 100 cm or less
C = 10	Ice with a thickness of 100 cm or more
D = 10	Ice with a thickness of 100 cm or less
E = 10	Ice with a thickness of 100 cm or more
F = 10	Ice with a thickness of 100 cm or less
G = 10	Ice with a thickness of 100 cm or more
H = 10	Ice with a thickness of 100 cm or less
I = 10	Ice with a thickness of 100 cm or more
J = 10	Ice with a thickness of 100 cm or less
K = 10	Ice with a thickness of 100 cm or more
L = 10	Ice with a thickness of 100 cm or less
M = 10	Ice with a thickness of 100 cm or more
N = 10	Ice with a thickness of 100 cm or less
O = 10	Ice with a thickness of 100 cm or more
P = 10	Ice with a thickness of 100 cm or less
Q = 10	Ice with a thickness of 100 cm or more
R = 10	Ice with a thickness of 100 cm or less
S = 10	Ice with a thickness of 100 cm or more
T = 10	Ice with a thickness of 100 cm or less
U = 10	Ice with a thickness of 100 cm or more
V = 10	Ice with a thickness of 100 cm or less
W = 10	Ice with a thickness of 100 cm or more
X = 10	Ice with a thickness of 100 cm or less
Y = 10	Ice with a thickness of 100 cm or more
Z = 10	Ice with a thickness of 100 cm or less







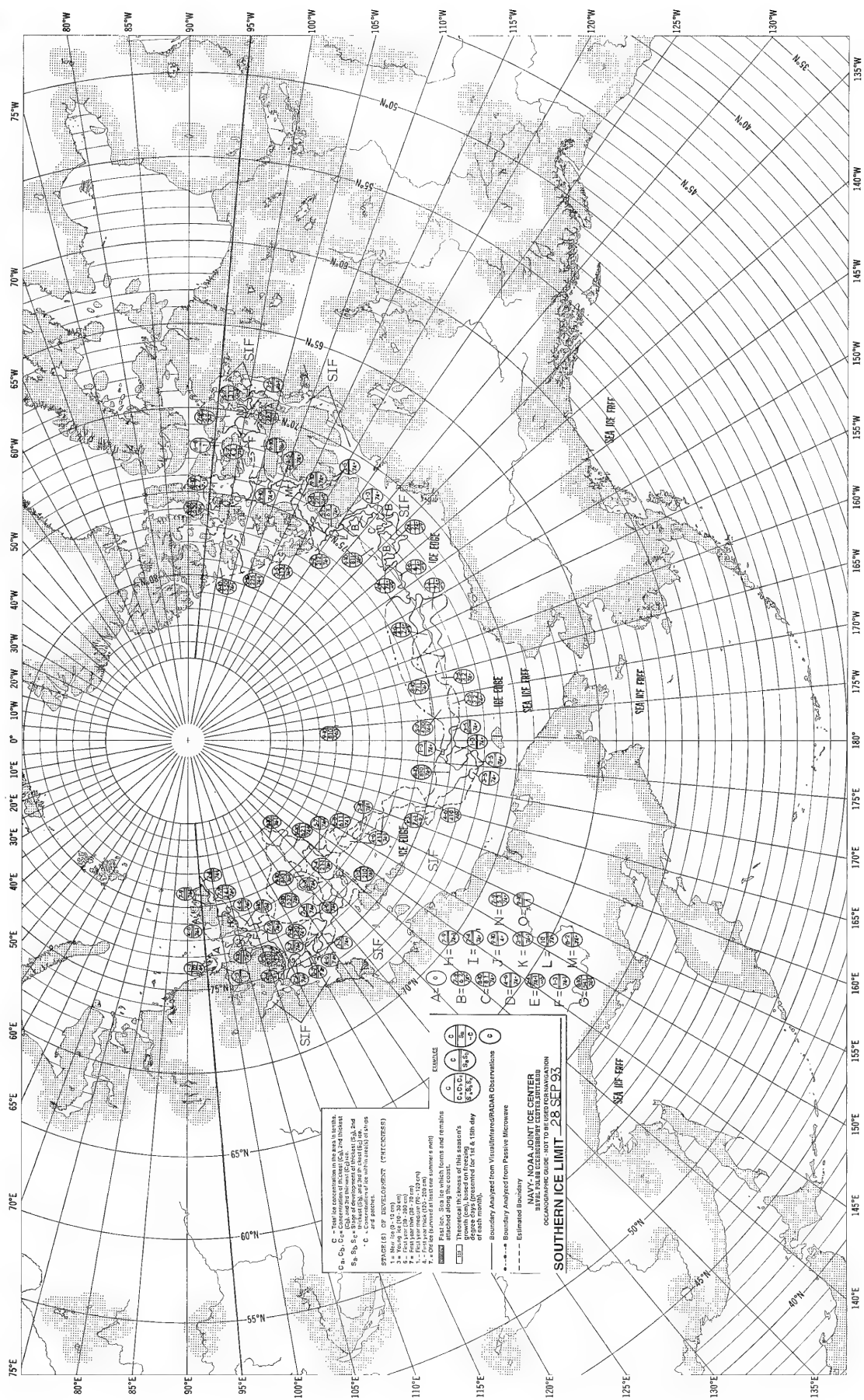


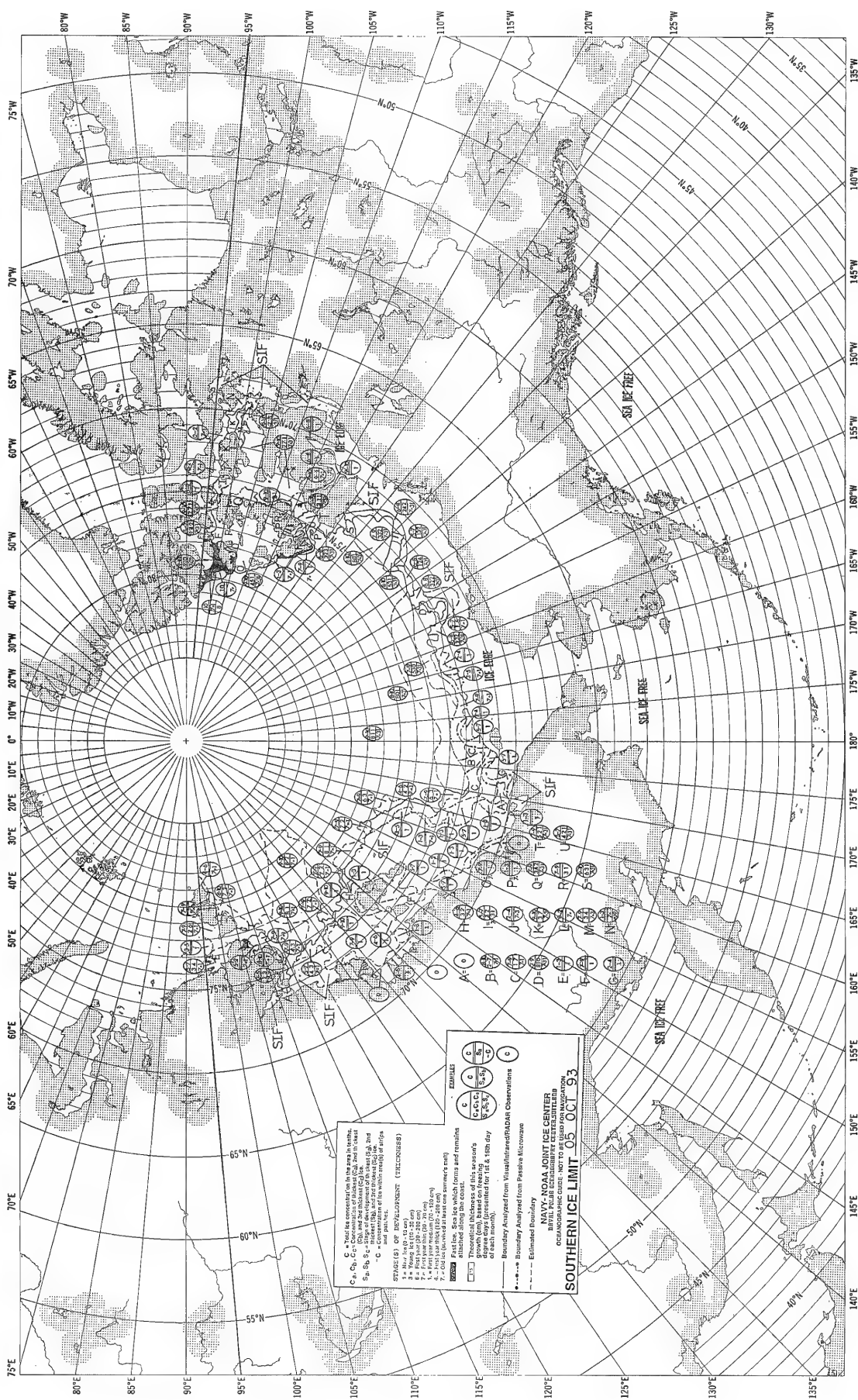
C = Sea ice concentration in the area of the month
 C₁, C₂, C₃ = Concentration of ice in the 1st, 2nd, and 3rd
 S₁, S₂, S₃ = Stage of development of ice in the 1st, 2nd, and 3rd
 C₁, C₂, C₃ = Concentration of ice in the 1st, 2nd, and 3rd
 S₁, S₂, S₃ = Stage of development of ice in the 1st, 2nd, and 3rd
 C₁, C₂, C₃ = Concentration of ice in the 1st, 2nd, and 3rd
 S₁, S₂, S₃ = Stage of development of ice in the 1st, 2nd, and 3rd

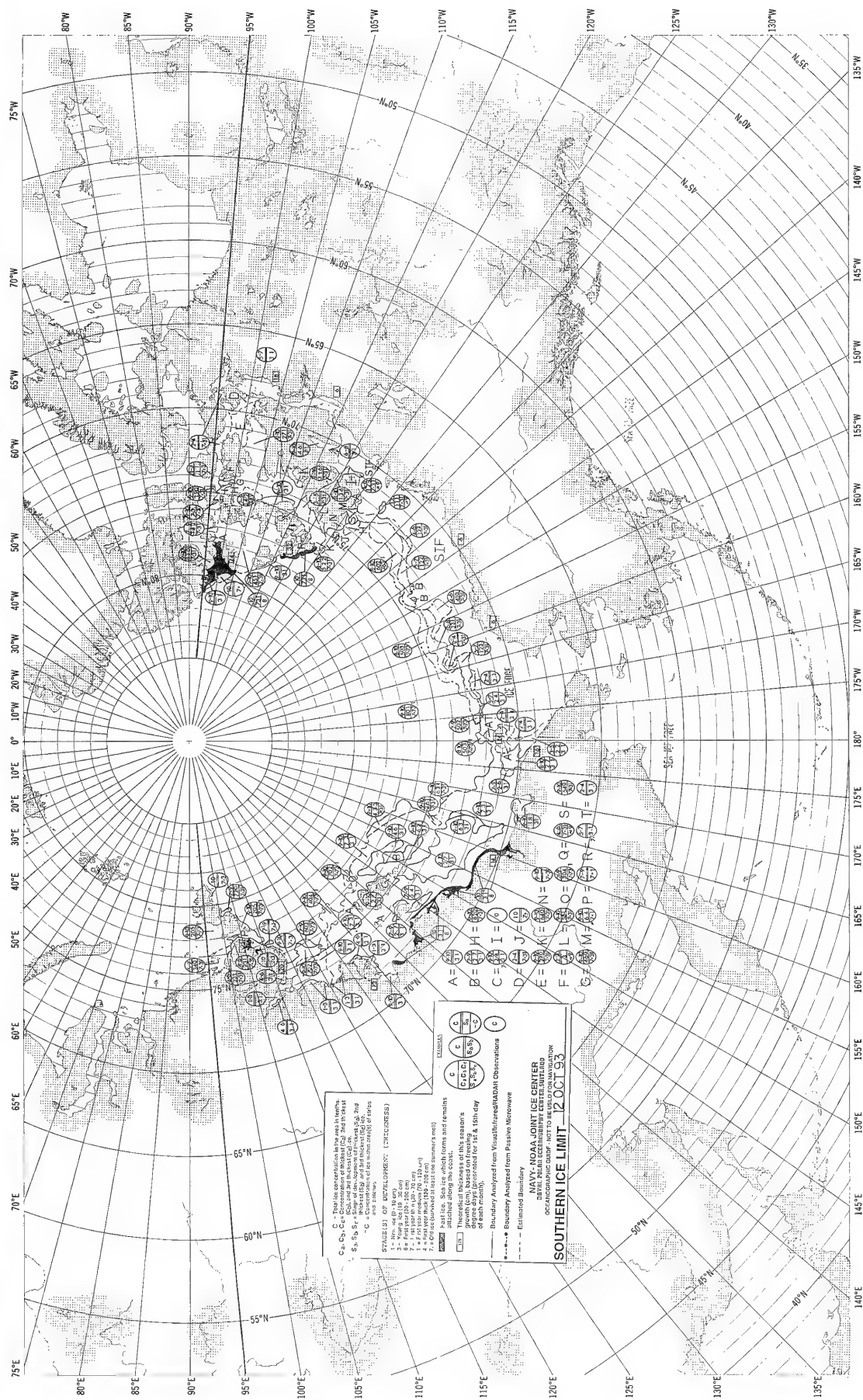
1 = New ice (0-15 cm)
 2 = Thin ice (15-25 cm)
 3 = Medium ice (25-50 cm)
 4 = Thick ice (50-100 cm)
 5 = Very thick ice (100-200 cm)
 6 = Ice edge (100-200 cm)
 7 = Ice edge (100-200 cm)
 8 = Ice edge (100-200 cm)
 9 = Ice edge (100-200 cm)

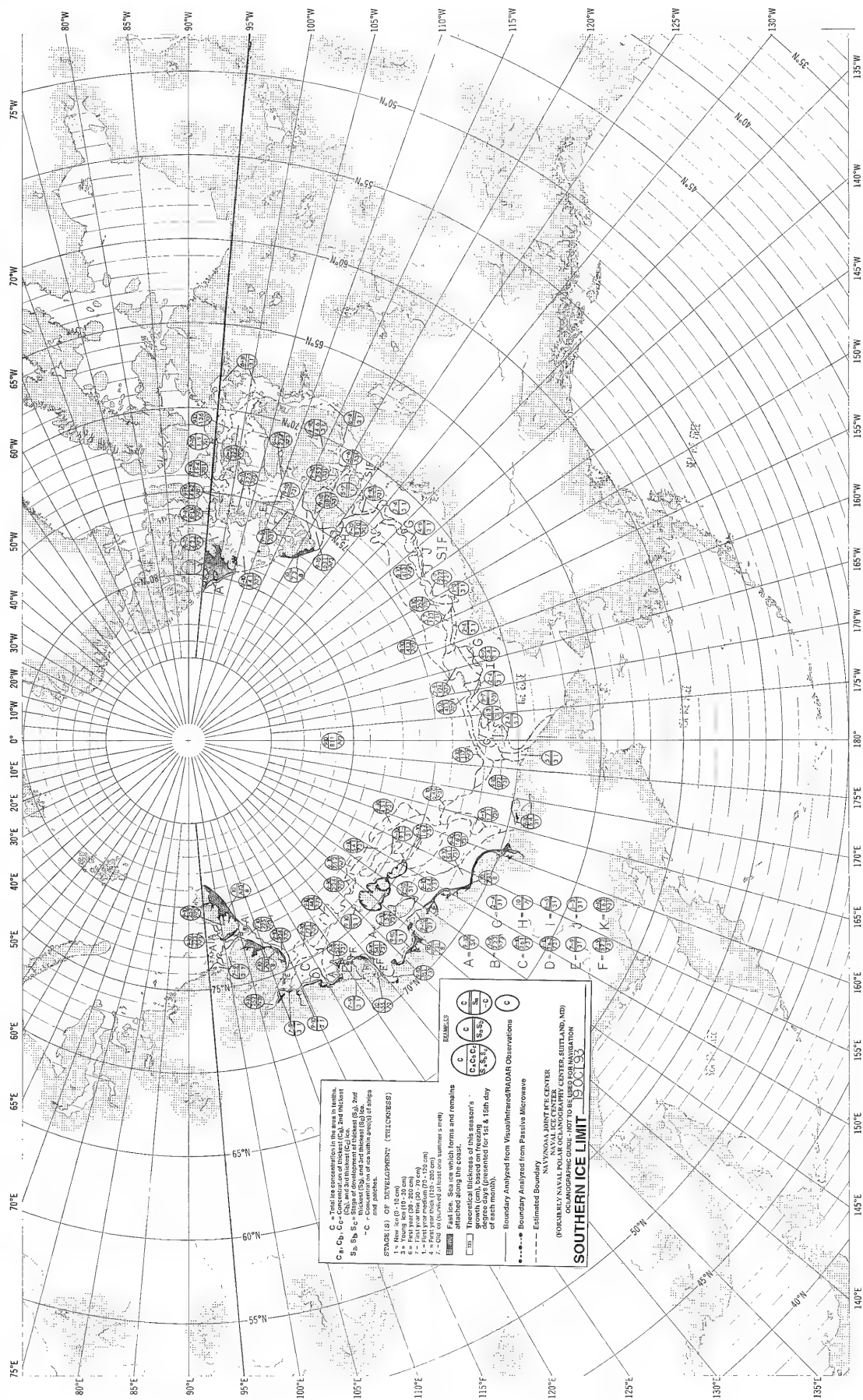
A = Boundary Analyzed from Visual Observations
 B = Boundary Analyzed from Radar Observations
 C = Boundary Analyzed from Satellite Observations
 D = Boundary Analyzed from Radar Observations
 E = Boundary Analyzed from Satellite Observations
 F = Boundary Analyzed from Radar Observations
 G = Boundary Analyzed from Satellite Observations

NAVY - NOAA JOINT ICE CENTER
 NORTHERN ICE CENTER
 SOUTHERN ICE LIMIT 21 SEP 93

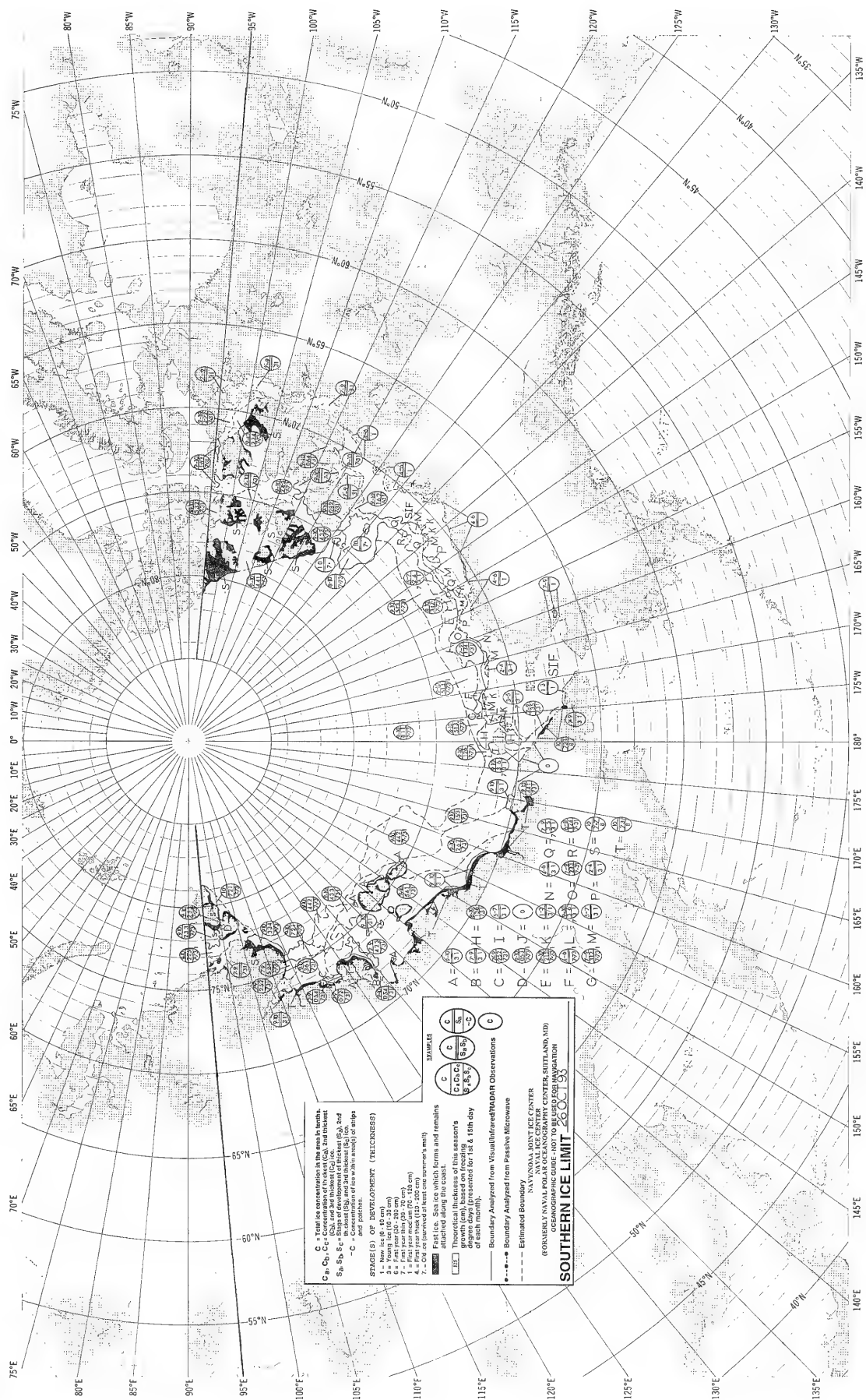


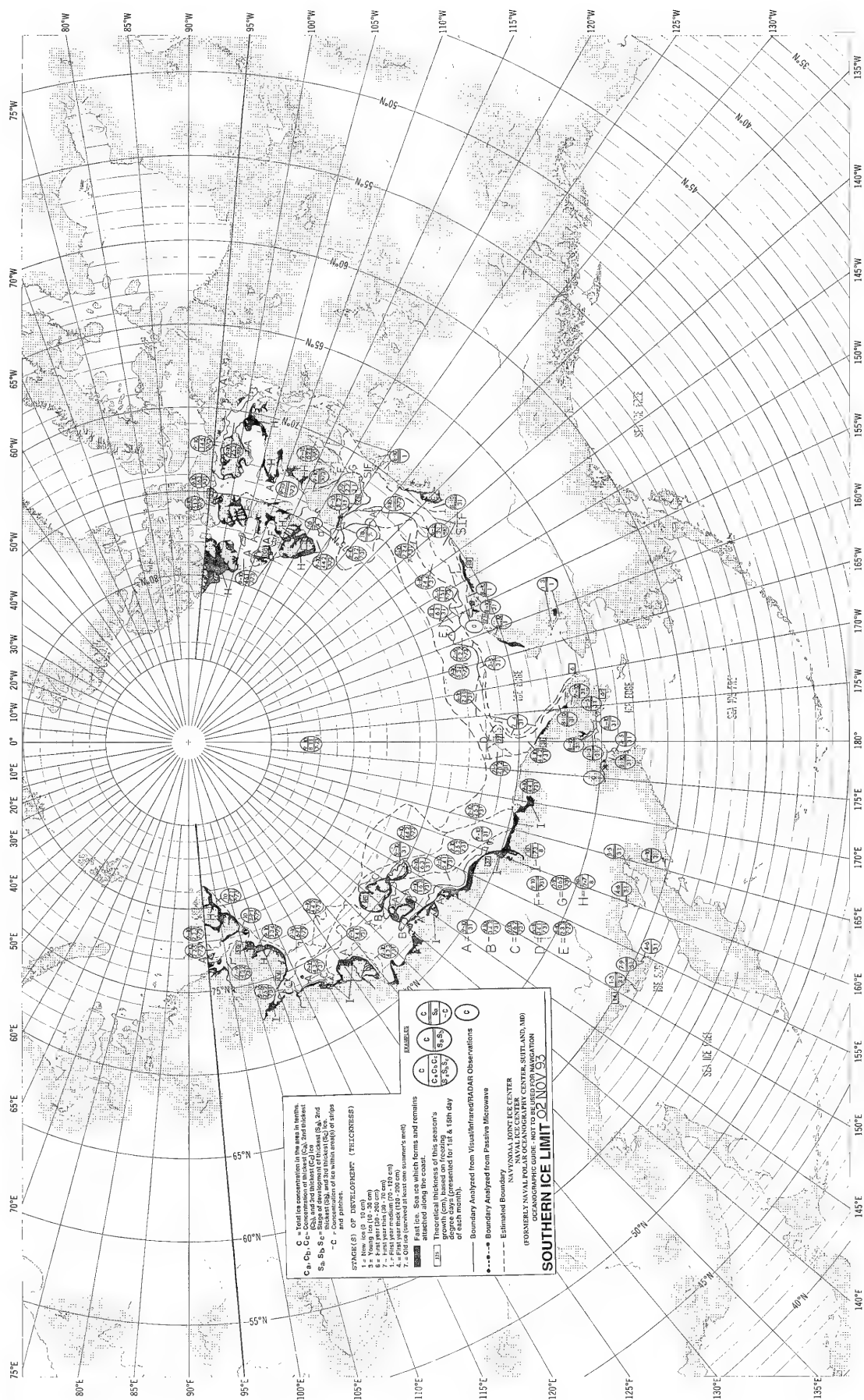


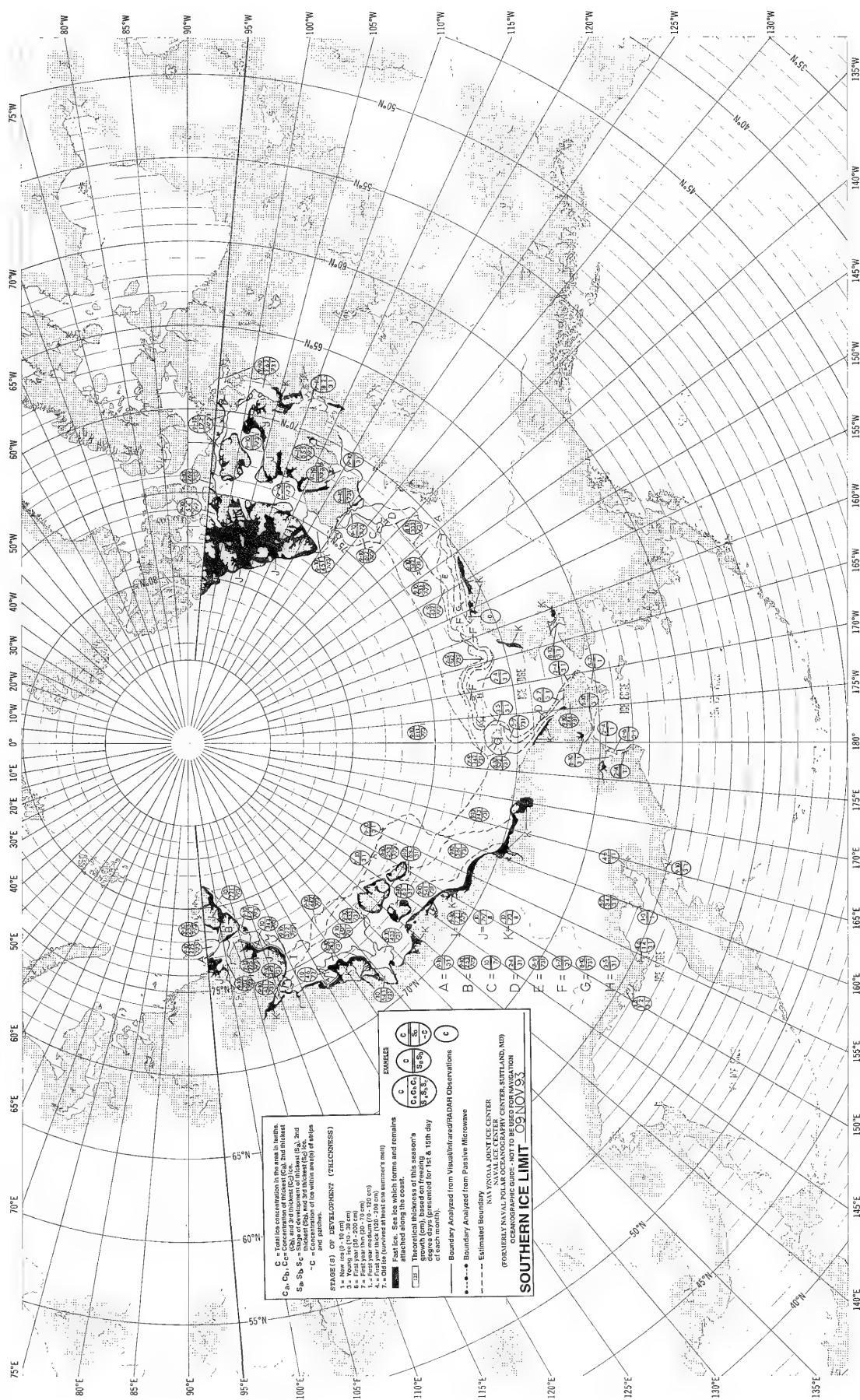


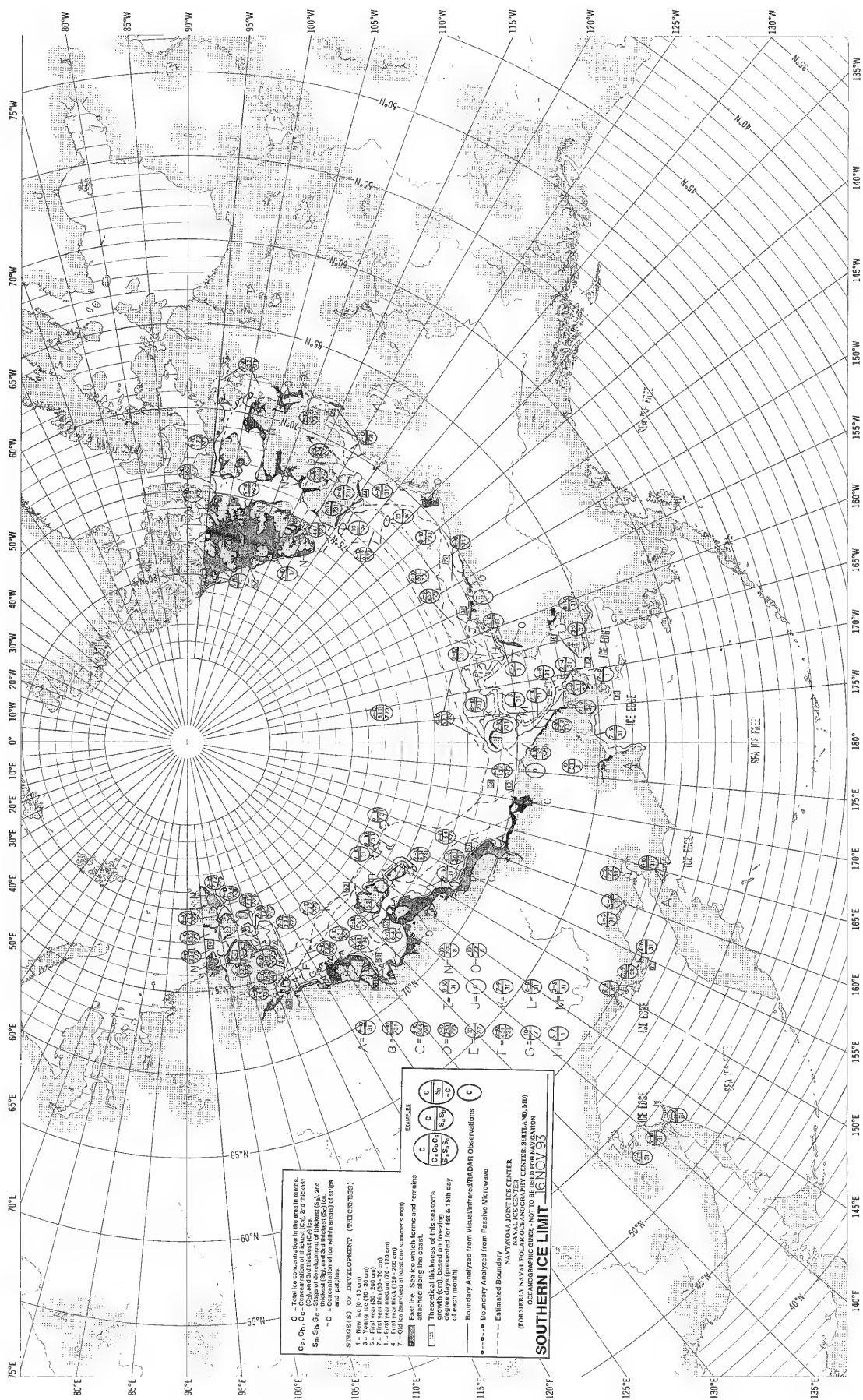


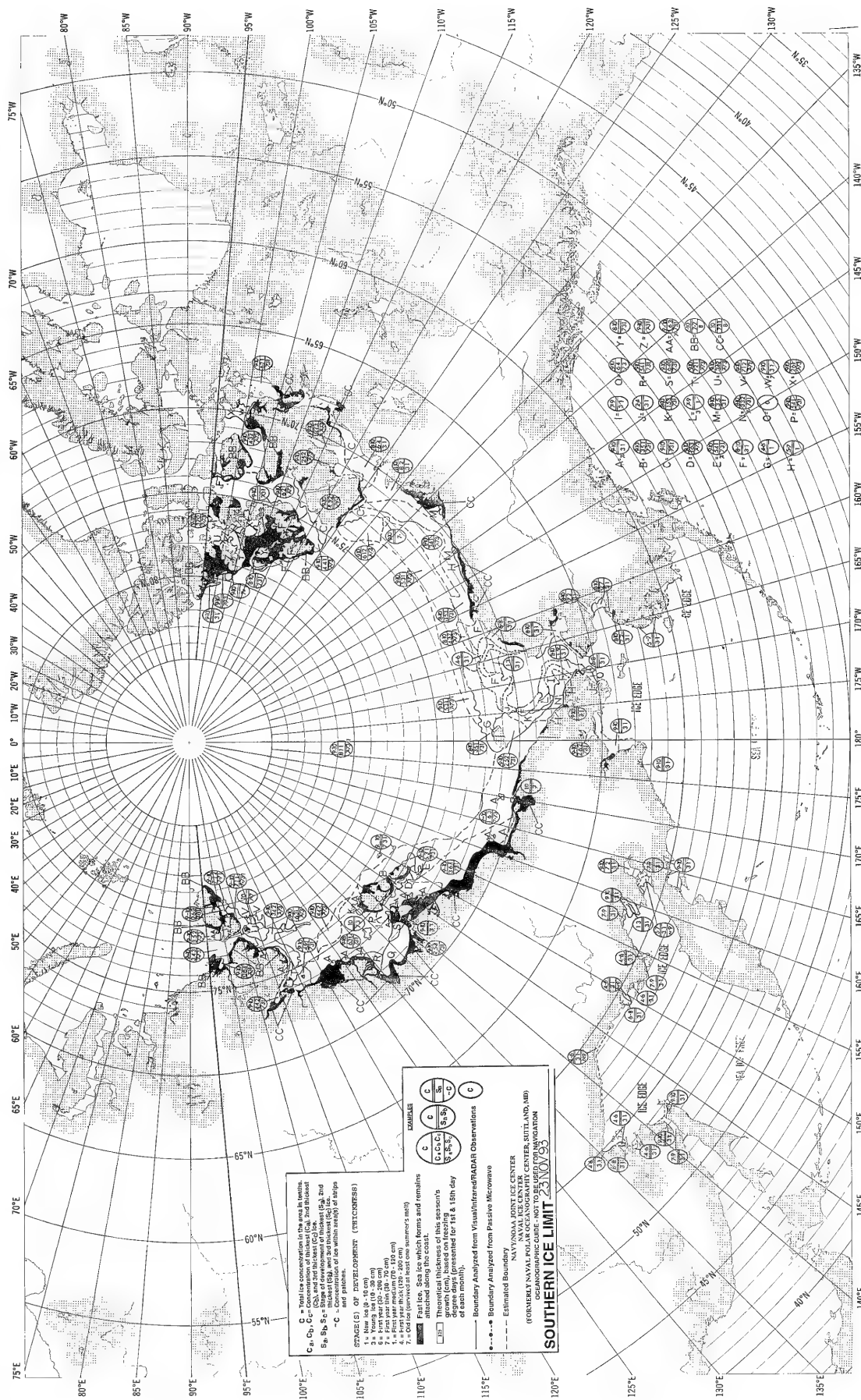
NAVY/NOAA JOINT ICE CENTER
 (FORMERLY NAVAL POLAR OCEANOGRAPHY CENTER, SUELAND, MD)
 OCEANOGRAPHIC GUIDE - NOT TO BE USED FOR NAVIGATION
SOUTHERN ICE LIMIT 150°E

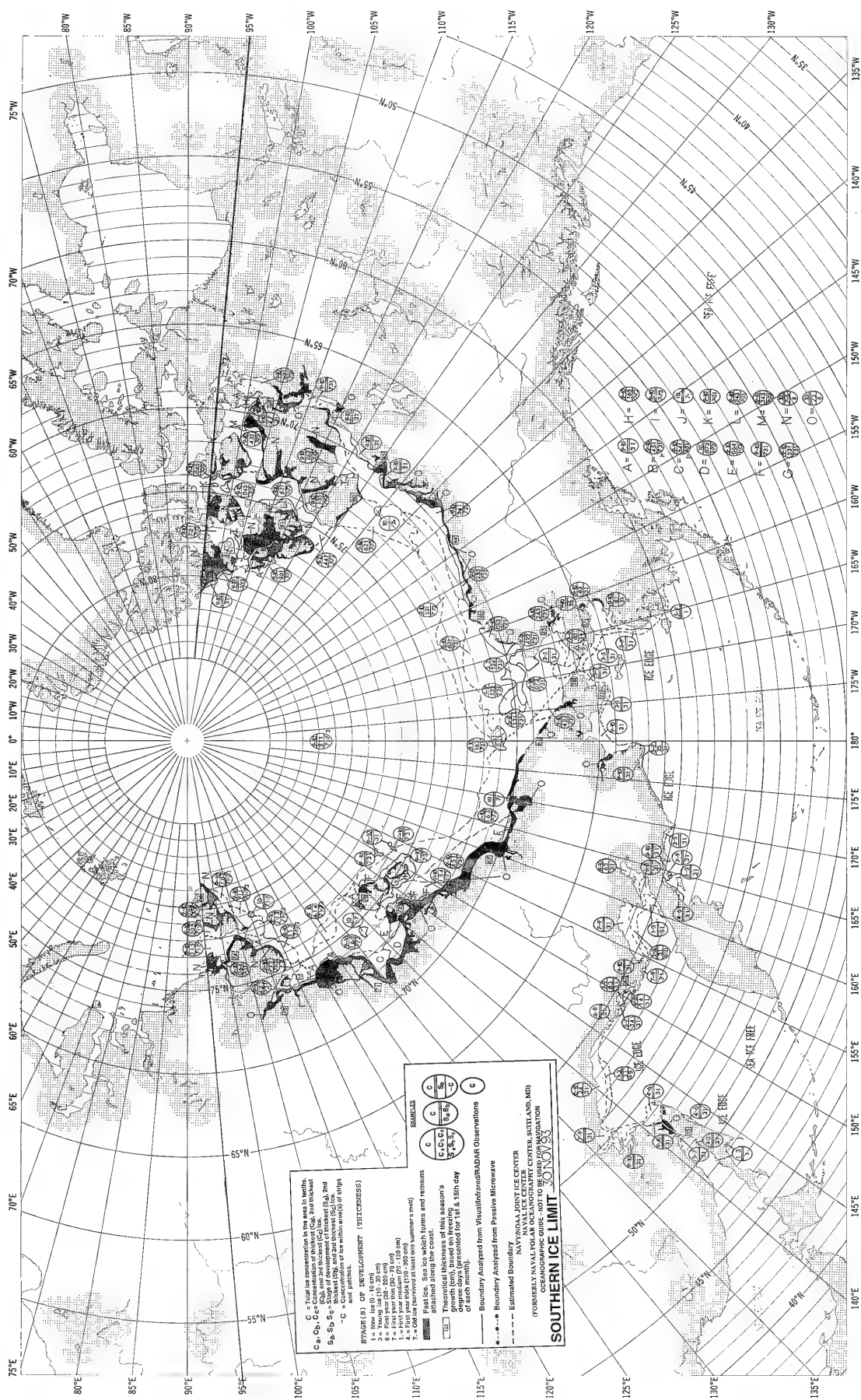


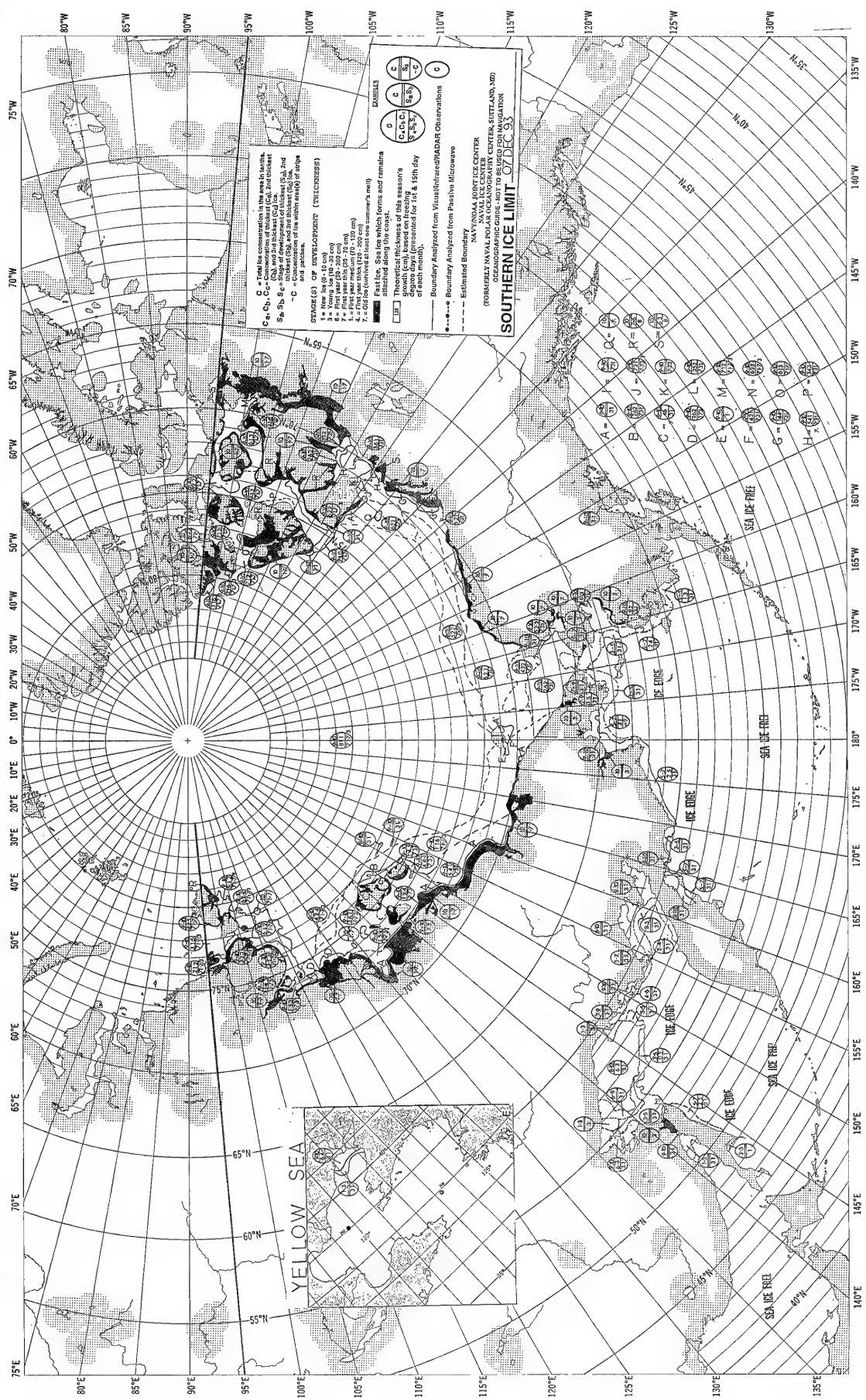


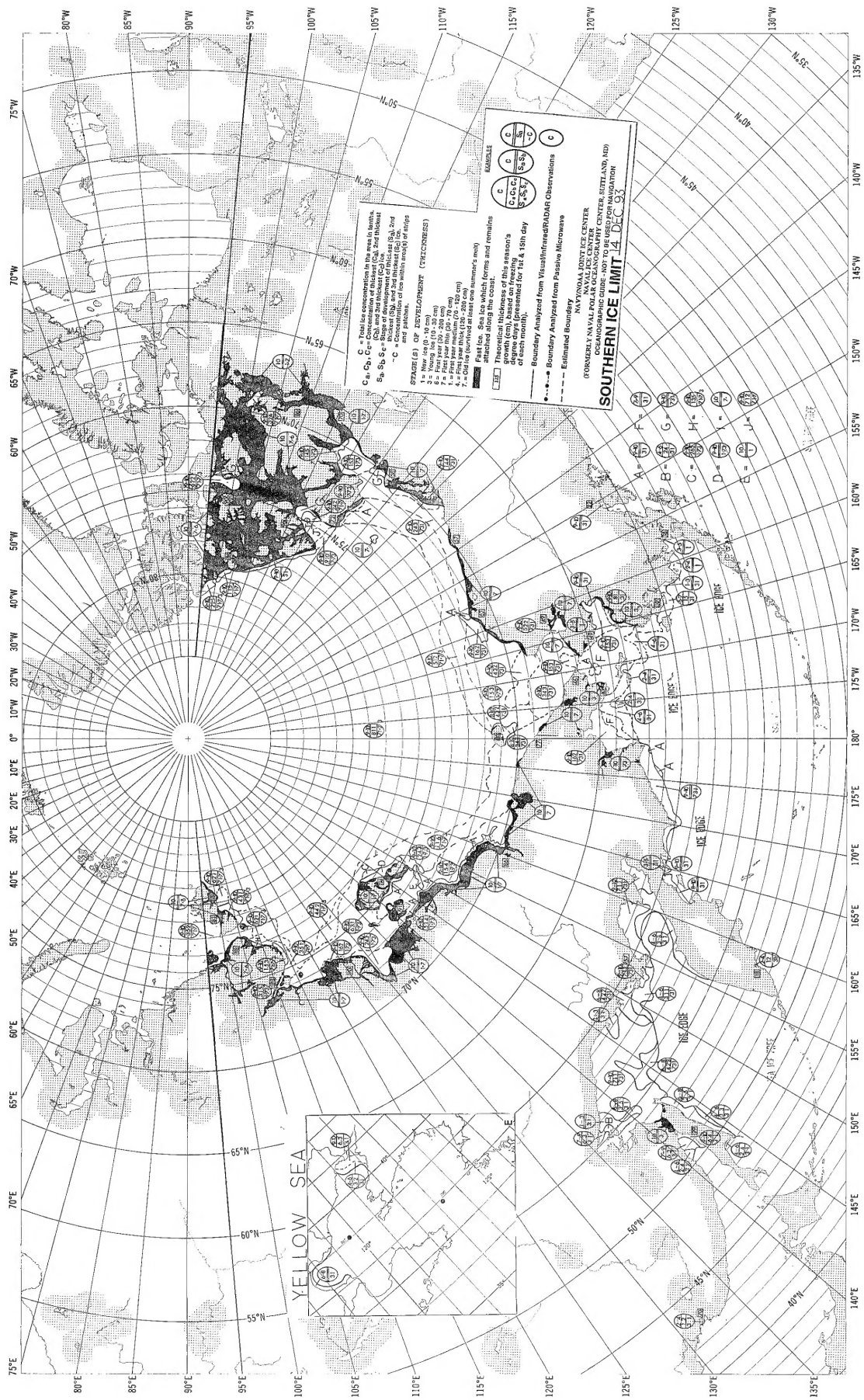












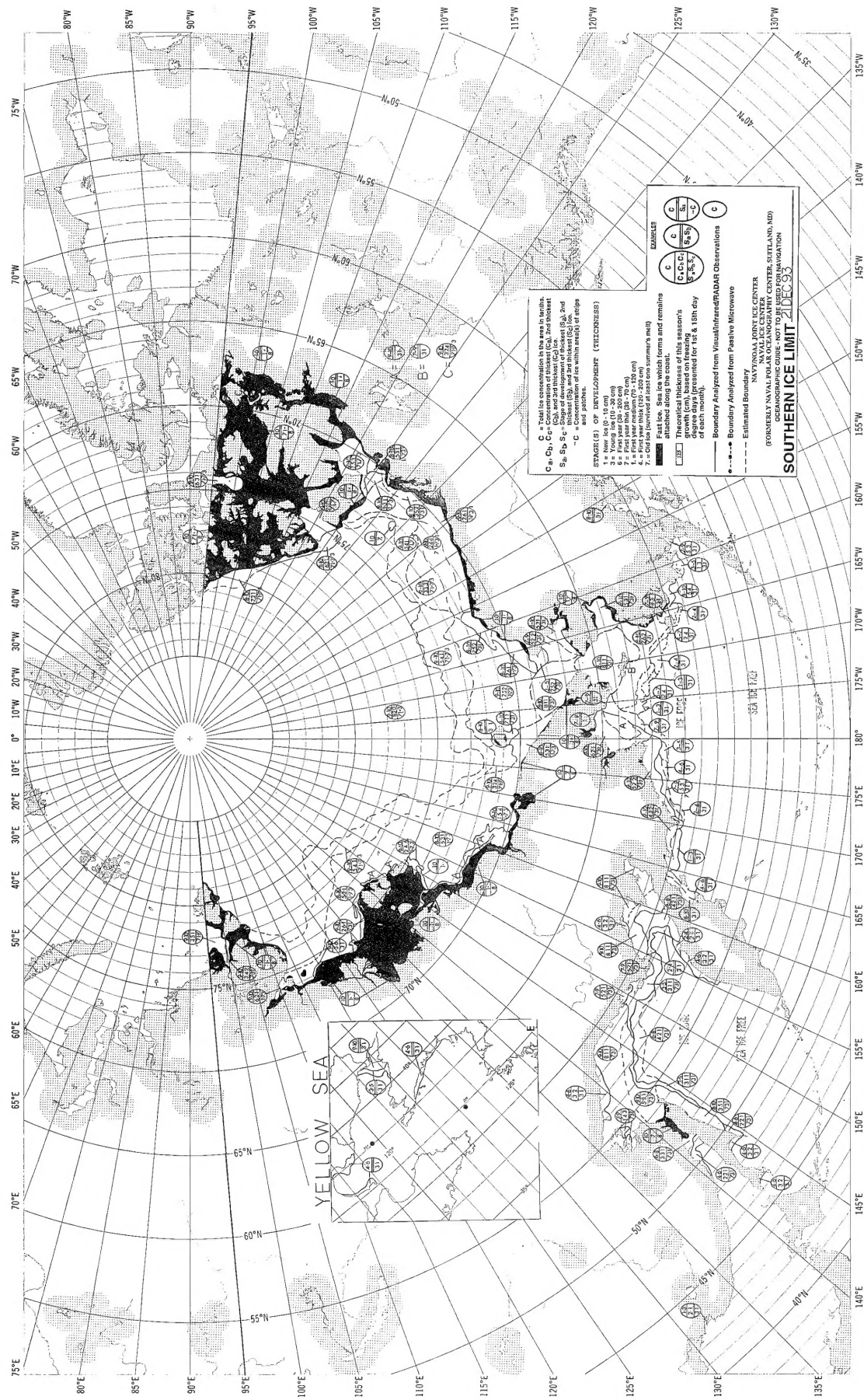


TABLE 1. SATELLITE DATA UTILIZED IN 1993

From	To	Sensor Platform	Sensor Type	Spectral Region	Resolution	Coverage
1-93	12-93	NOAA 10,11,12	<u>AVHRR</u> <u>HRPT/LAC</u> VIS NIR IR	0.58-0.68 um 0.725-1.10 um 10.5-12.5 um	1.1 km at nadir	Regional
			<u>GAC</u> VIS IR	0.58-0.68 um 10.5-12.5 um	4 km	Global
1-93	12-93	DMSP F-10,11	<u>OLS FINE</u> VIS IR	0.4-1.1 um 10.2-12.8 um	0.55 km 0.55 km	Regional Regional
			SSM/I PMW	1.55 cm (19.35 Ghz) and 0.81 cm (37.00 Ghz)	50 km 25 km	Global Global
1-93	12-93	ERS-1	<u>SAR</u> AMW	C-Band (5.3 Ghz)	100 m -240 m	Local
						Local

Abbreviations and Acronyms:

AVHRR--Advanced Very High Resolution Radiometer

AMW--Active Microwave

cm--centimeter

GAC--Global Area Coverage

GHZ--Giga-Hertz

HRPT--High Resolution Picture Transmission

IR--Infrared

km--kilometer

LAC--Local Area Coverage

NIR--Near Infrared

OLS--Operational Line Scan System

PMW--Passive Microwave

SSM/I--Special Sensor Microwave Imager

um--micrometer

VIS--Visible